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FEBRUARY, 1954

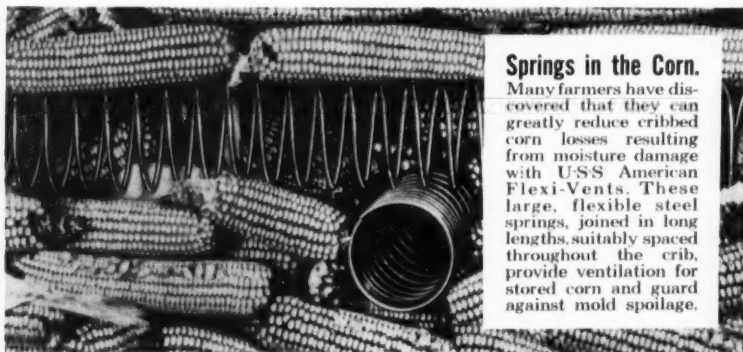
VOL. 19, NO. 5

25 CENTS

Only STEEL can do so many jobs so well



Steel and the Stars seem unrelated. But in almost every attempt man makes to learn more about his universe, to build bridges to the unknown, steel plays a vital part. Here, for example, in the Palomar Observatory housing the 200-inch Hale telescope—world's largest—the rotating dome with precision balanced shutters is made of *steel*, fabricated and erected by United States Steel. Only steel can do so many jobs so well.



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Many farmers have discovered that they can greatly reduce cribbed corn losses resulting from moisture damage with USS American Flexi-Vents. These large, flexible steel springs, joined in long lengths, suitably spaced throughout the crib, provide ventilation for stored corn and guard against mold spoilage.



Zoot Chute. In the processing of anthracite coal, the best-dressed coal chutes, these days, are wearing linings of Stainless Steel. For where ordinary carbon steel chutes wear out and have to be replaced in 2 months, chute linings of stainless steel give 5 years of efficient service. In addition to hundreds of tons of coal, 17,500 gallons of water flow over these chutes each day.

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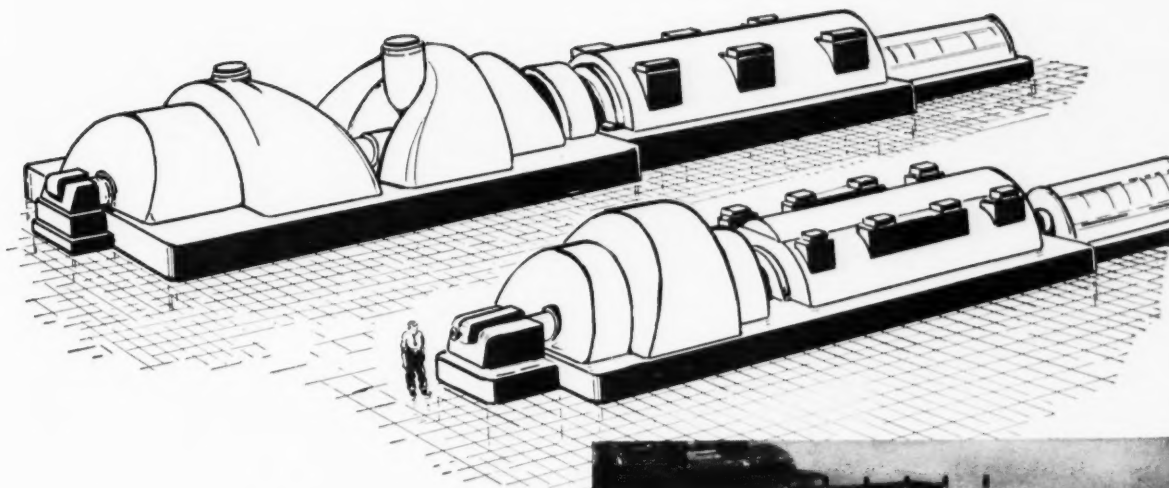
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Mammoth generators of the cross compound type (2000 pounds pressure at 1050 F initial temperature and 1000 F reheat) being built by General Electric Company and Westinghouse Electric Corporation for Detroit Edison.



Largest turbine generators in the world are now being built for Detroit Edison's newest power plant, at River Rouge. There are two units, each with a capability of 260,000 kw. When the plant is completed, it will house six units, together with their giant boilers . . . enough capacity to supply 2,500,000 people.

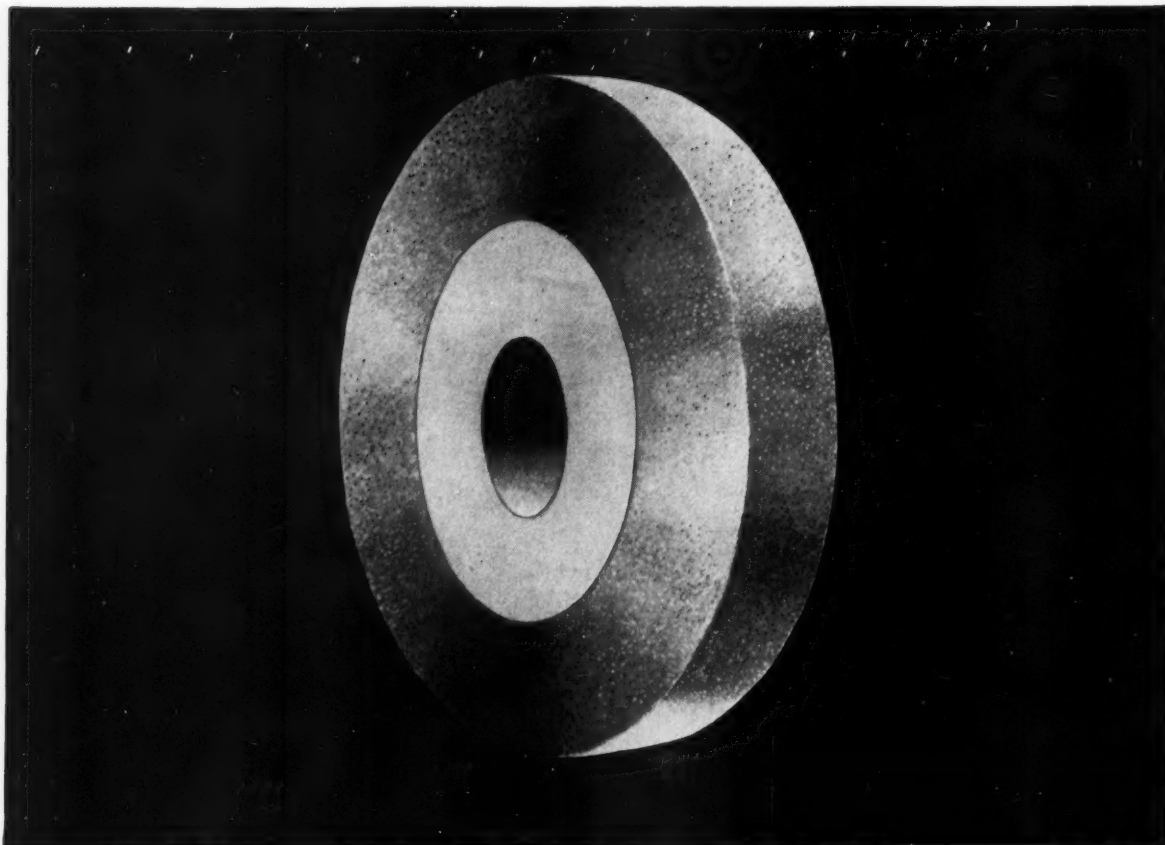
To you young men thinking about your careers, pioneering like this is a symbol of expansion and opportunities for advancement. You may find just what you want in this rapidly growing electric company.

Detroit Edison offers a firm foundation on which to build a career. Planned on-the-job training, orientation programs, provide new engineers with opportunities to explore all major departments in the Company. We have up-to-date, progressive employe benefits . . . including group insurance, hospitalization, retirement and annuity plans.

There is a future for you at Detroit Edison. Drop in and see us when we visit your campus; stop in when you are in Detroit; or write. . . .

The DETROIT EDISON Company

2000 Second Avenue, Detroit 26, Michigan



HIDDEN HENCHMAN ...

Early man used Nature's rocks and stones to shape and sharpen his crude tools and weapons. Today, industry has at its command abrasives that will do in seconds jobs that formerly required days of tedious toil.

Yet relatively few people know or appreciate the vital labor-saving, back-stage role which abrasives play in the production of practically all mechanically finished articles.

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Through the centuries man's ceaseless search for better abrasives has paralleled progress in production. Wheel-shaped sandstones replaced rocks ... only to give way to emery and corundum, which were sieved, sized, glued to paper and cloth or bonded in pottery mixtures to form artificial grinding wheels.

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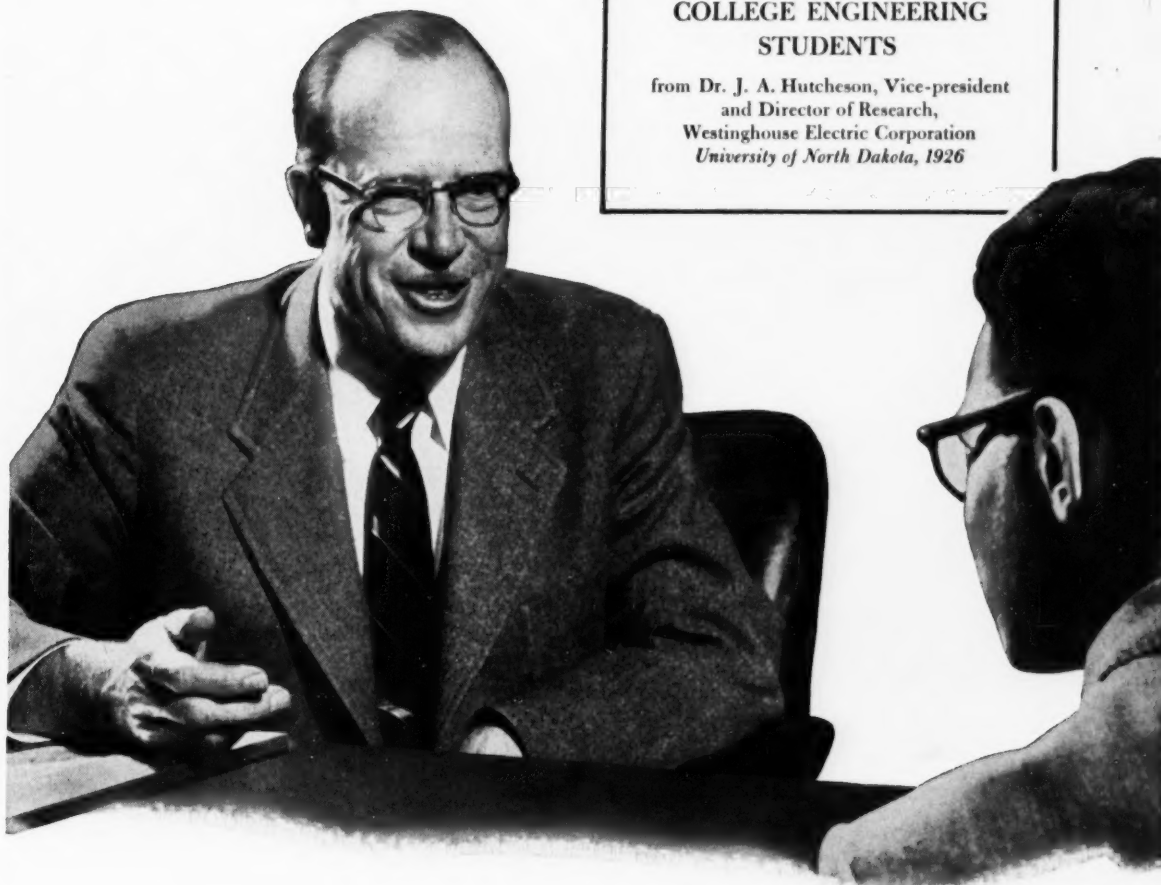


HEADQUARTERS FOR TECHNICAL AND BUSINESS INFORMATION



**A MESSAGE TO
COLLEGE ENGINEERING
STUDENTS**

from Dr. J. A. Hutcheson, Vice-president
and Director of Research,
Westinghouse Electric Corporation
University of North Dakota, 1926



To the young man bent on conquering the unknown

Behind every successful career, there's a driving force. An inspiration, an ambition—call it what you will—that spurs a man on.

It has been interesting to me to watch the progress of the young men in our research departments . . . watch their ambitions take shape. Men, who only yesterday, it seems, came to us from the universities, and are now engaged in vital projects in our applied and fundamental research programs. These young men are exploring the unknown—looking for something better than ever before. It's a challenging life—and a rewarding one.

But what does this mean to you as a graduate? It means your abilities, your education, *and your ambitions* may carry you to undreamed of heights. Here at Westinghouse, we recognize ambitions as well as abilities, and do everything in our power to encourage them. You are assisted in reaching your goals by means of carefully developed training programs. You are given the opportunity to pursue graduate work toward Masters' and Ph.D. degrees. Here, you are treated as an individual.

You who are bent on conquering the unknown are welcome at Westinghouse.

G-10274

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Westinghouse**

For information on career opportunities with Westinghouse, consult the Placement Officer of your university, or send for our 44-page book, *Finding Your Place in Industry*.

Write: Mr. P. B. Shiring, Regional Educational Co-ordinator, Westinghouse Electric Corporation, Ellicott Sq. Bldg., Buffalo 3, New York.





A true human equation?

We at General Motors think it is.

For, as a writer in our Engineering Journal phrases it:

"Every engineer must know how to make and read engineering drawings, because it is the basic method upon which all designing and subsequent manufacture is based. It is certainly not a language to be learned only by the comparatively few draftsmen who will be professional writers of it. But rather it must be thoroughly understood by all who are connected with technical industry."

That's why we take a dim view of the present trend for recent graduates to short-cut the drafting and designing room. For—not to mention the harm to the profession and to the industries it serves—there is even greater harm to a young engineer's chances to build a sound career for himself.

So—in discussing the many opportunities that await the talented, hard-working engineering graduate who elects to join the General Motors family—we must be completely frank:

Those opportunities often start on a drafting board.

But on that drafting board you can blueprint a blue sky future for yourself—which can range from high positions in engineering, manufacturing, projection, sales or service—even to the top management group.

How about checking with your College Placement Office and arranging for an interview with our GM College Representative the next time he visits your campus. Let him help you prepare to draft a sound and satisfactory future at General Motors.

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METALLURGICAL ENGINEERING
CHEMICAL ENGINEERING
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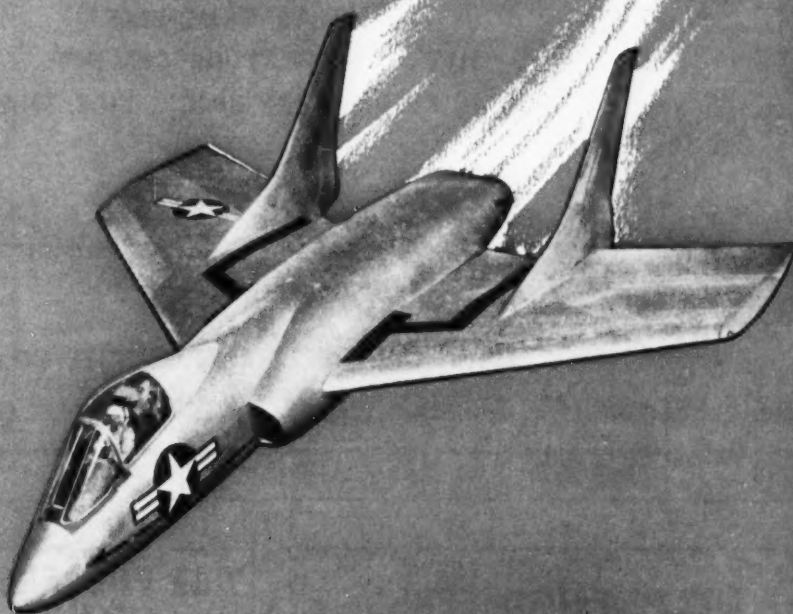
GENERAL MOTORS CORPORATION

Personnel Staff, Detroit 2, Michigan



36

YEARS OF NEW IDEAS



TO MAINTAIN a top position in the aircraft industry for more than 36 years requires the engineering of new designs through the application of engineering experience plus imaginative thinking. Chance Vought Aircraft has offered the opportunity for such a career since the day of its founding in 1917 when it began the design of the VE-7, a two-seated biplane which was redesigned for the Navy as the VE-9.

During the past 36 years young engineers and scientists have been an important source of these new ideas. Today, more so than ever before, many interesting career opportunities are available at Chance Vought as the company designs the latest versions of the F7U-3 Cutlass, the "Regulus" guided missile and other high speed fighter aircraft projects.

The achievements of the past 36 years at Chance Vought, great as they have been, offer little means of evaluating fully the potential of aviation's future. If you are interested in a position with an unlimited future, a position with the constant responsibility of evaluating and applying new ideas, if you are interested in working for a company with a wealth of experience in its line and yet ambitious to create the latest designs in its field, investigate the employment opportunities at Chance Vought.

Engineering and scientific graduates are invited to contact their Placement Officer to arrange for a personal interview when the Chance Vought Engineering Personnel Representative visits on campus.

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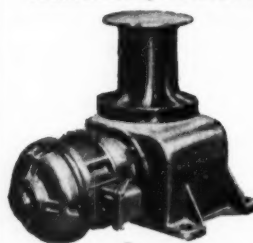


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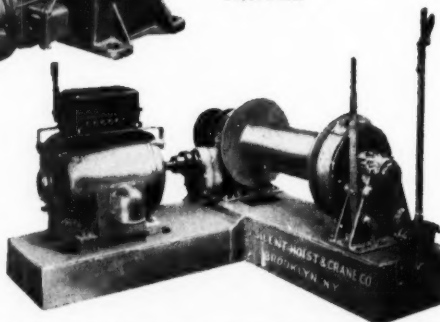
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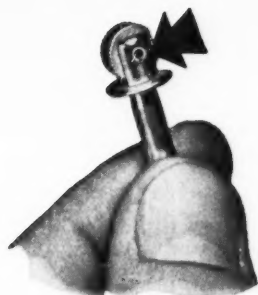


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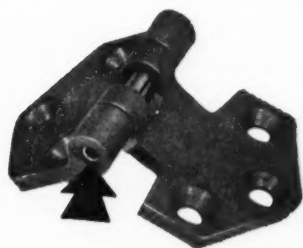


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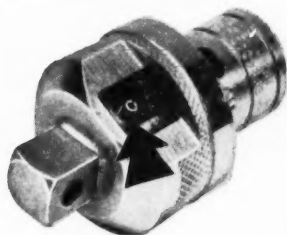
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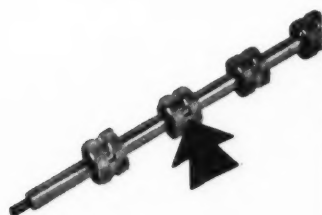
Replacing a rivet



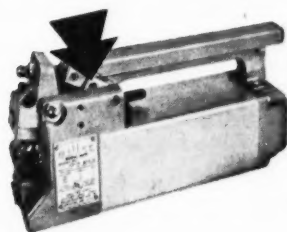
... a hinge pin



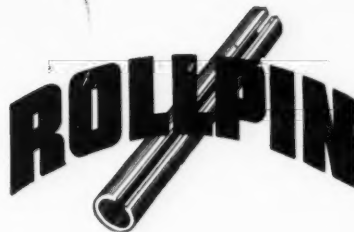
... a stop pin



... a set screw



... a bolt and nut



dia. from
1/16" to 1/2"

... a modern fastener that saves time and money on thousands of applications

Rollpin is a hollow, split, cylindrically formed pin with chamfered ends. It is simply driven into holes drilled to normal production tolerances. Because Rollpin is slightly larger than standard sized holes, it compresses as inserted. It is self-locking—and vibration-proof—because of the constant pressure it exerts against hole walls. Its shear strength exceeds that of a cold rolled pin of the same diameter. Rollpin is readily removed with a drift or pin punch—and can be reused.

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*Elastic Stop Nuts with the famous red collar
are another ESNA product*



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Hercules' business today helps almost everyone's business. It embraces the production of synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products, and many other chemical processing materials—as well as explosives. Through close cooperative research with its customers, Hercules has helped improve the processing or performance of many products.



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Paper towels absorb more moisture without falling apart when Hercules Kymene® resins are added in manufacture. These resins, a few of many of Hercules' varied papermaking chemicals, help improve many other types of wet-strength papers and paperboard, including map paper, V-board, and bag papers.

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FEBRUARY, 1954

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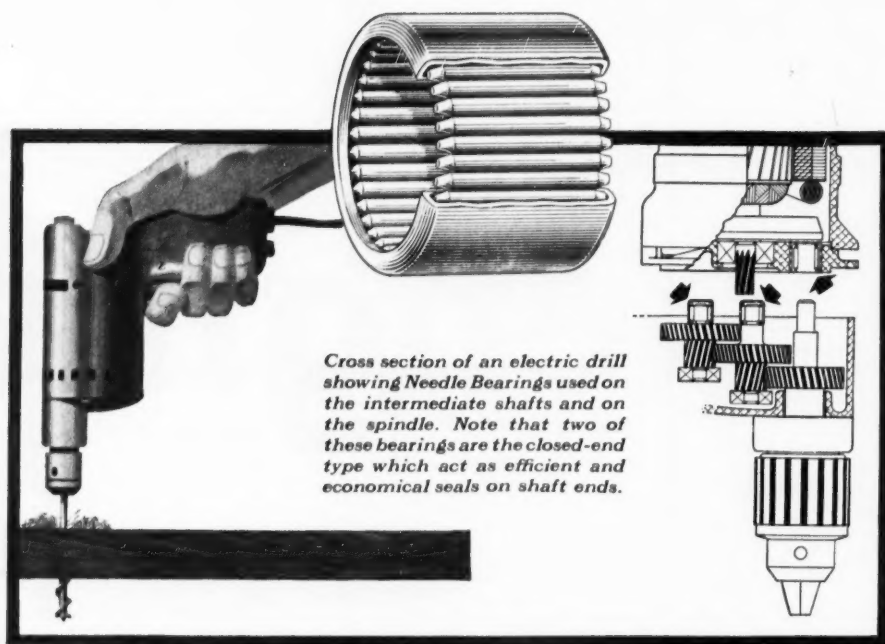
COVER—Johnny Parsons Club on Beebe Lake at Cornell.

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Published monthly—October to May—by the CORNELL ENGINEER, Inc., Lincoln Hall, Ithaca, N. Y. Edited by the undergraduates of the College of Engineering, Cornell University. Entered as second class matter at the Post Office at Ithaca, N. Y., under Section 103, Act of October 3, 1917.

Subscription per year: regular \$2.00; with membership in the Cornell Society of Engineers \$3.00 (See President's page); student \$1.50; single copy \$.25.



Cross section of an electric drill showing Needle Bearings used on the intermediate shafts and on the spindle. Note that two of these bearings are the closed-end type which act as efficient and economical seals on shaft ends.

TORRINGTON NEEDLE BEARINGS *help make products more compact*

These days, design engineers have to consider sales charts as well as blueprints and specifications.

Two portable electric drills, for example, may have the same capacity, the same speed, the same chucks and the same price, yet one may outsell the other. Factors like overall appearance, compactness, and light weight often contribute to product success.

Unique Design Promotes Compact Designs

The Torrington Needle Bearing has been used in many products because of the weight and space

savings it affords. Its unique design—a thin hardened outer shell retaining a full complement of small diameter rollers—gives it maximum capacity in minimum space. In fact, for its size and weight, the Needle Bearing can carry higher radial loads than any other type of anti-friction bearing.

Permits Reduction in Size and Weight of Related Parts

In the electric drill shown here the small size of the Needle Bearing permits close shaft center distances to make for overall compactness. And, since Needle

Bearings are press-mounted in plain round housing bores—without retaining rings or shoulders—housing can be made smaller and lighter. The fact that Needle Bearings require no inner race when running on hardened shafts results in further savings, without sacrificing capacity or durability.

Needle Bearings are in use on many other products where compactness and light weight are important design factors. Aircraft, small gasoline engines, hydraulic pumps and materials handling equipment are just a few of the products that utilize the Needle Bearing's high capacity and small size to good advantage.

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teeth for a 1000 h.p. bite...

Undoubtedly you will recognize this application of a familiar technique for studying stresses. In this case, it was used to develop gears that are less than 5 inches in diameter yet easily transmit over 1000 horsepower.

Inherently, the design and development of aircraft engines offers unusual opportunities for applying basic engineering principles learned in school. In few other places can a technical graduate utilize his education and abilities

more fully — gain recognition and advancement.

Many of our engineers who had important roles in developing the most powerful jet engine known to be in production — rated in the 10,000-pound thrust class — are still in their twenties.

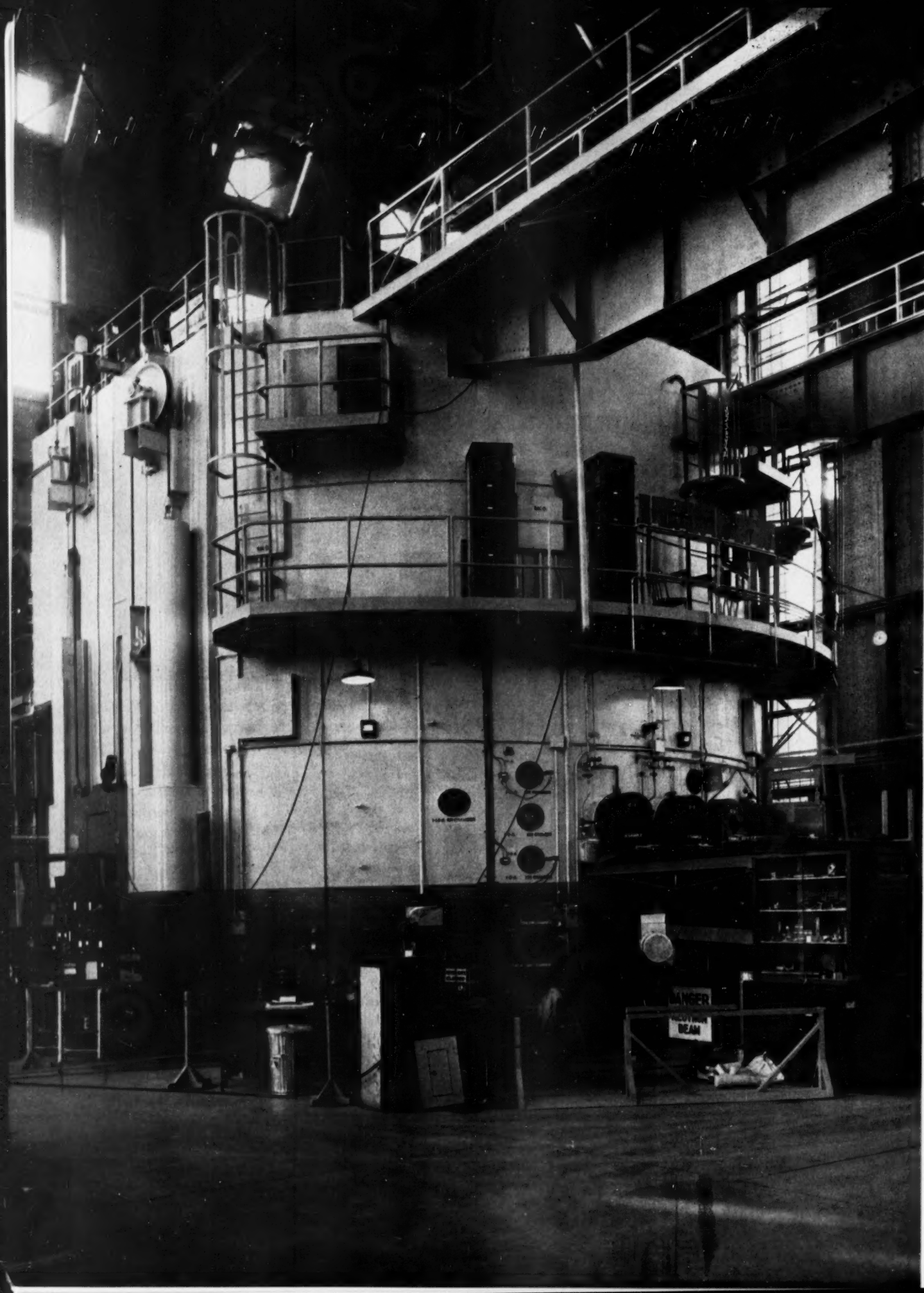
To those young graduates who can see the career possibilities in the rapidly evolving field of aircraft propulsion, we can offer a real opportunity for growth and professional development.

PRATT & WHITNEY AIRCRAFT

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East Hartford 8,

Connecticut



Control of Atomic Energy

The McMahon Atomic Energy Act

by JOHN AHEARNE, EP '57

At the close of 1952, atomic energy was America's biggest business, with a total government investment in plants and equipment of \$4,000,000,000 and an additional \$3,500,000,000 authorized for new construction. With the rapidly approaching advent of economical, industrial, and public power reactors, the means of legal control of atomic energy becomes a matter of pertinent interest to the general public, and especially to the engineering profession. The law of the United States for the development and control of atomic energy is the McMahon Atomic Energy Act. A knowledge of the major points of this act should be very useful in keeping abreast with the future developments in industrial and public atomic power plants.

The purpose of the Act is to direct the development and utilization of atomic energy toward improving life in a free world, "subject at all times to the paramount objective of assuring the common defense and security." Toward this end it provides for five major programs: the encouragement of private research and development; the control, dissemination, and sharing of scientific and technical information; federally conducted research and development; "government

control of the production, ownership, and use of fissionable material to assure the common defense and security and to insure the broadest possible exploitation of the fields"; and an administration consistent with these policies and the international arrangements of the United States, one which will notify Congress if the need arises for further legislation.

The Atomic Energy Commission

The principal body set up by this act is the Atomic Energy Commission. This is a group of five men who are appointed by the President with the consent of the Senate; the Chairman is designated by the President. The term of office for a member of the Commission is five years, with one member's term expiring each year. The President has the power to remove any member; no member can be engaged in any occupation other than serving as a member of the Commission.

A General Manager is established within the Commission whose duties are administrative and executive under the Commission's direction. He is appointed, paid, and removed solely by the Commission. Also within the Commission are Divisions of Research, Production, Engineering, and Military Applications, the chairman of the latter being a member of the armed forces.

The second major body is the General Advisory Committee, whose duty is to advise the Com-

mission on "scientific and technical matters relating to materials, production, and research and development." This Committee is composed of nine civilians, appointed by the President for a term of six years, three terms expiring every two years.

The last major body is the Military Liaison Committee. It consists of a chairman and a representative(s) of the Departments of the Army, Navy, and Air Force, designated by the respective Secretaries of these departments. The Chairman is appointed by the President with the consent of the Senate. The Committee's duty is to advise and consult with the Commission "on all atomic energy matters which the *Committee* [sic] deems to relate to military applications." The Committee has a liaison duty between the Commission and the Department of Defense. If the Committee decides that an action of the Commission is adverse to the Defense Department's duties, they may refer such action to the Secretary of Defense; upon his concurrence, the matter is referred to the President, whose decision shall be final.

The Act directs the Commission to encourage and assist in the continuation of theoretical and practical research and development. In accordance with this duty, the Commission is authorized to make "contracts, agreements, and loans" for the conduct of research and development activities relating to "the

Nuclear reactor in Chalk River National Research Laboratory.

theory and production of atomic energy"; "utilization of fissionable and radioactive materials for medical, biological, health, or military purposes" and for industrial uses; and the "protection of health during research and production activities." For the same purposes, the Commission is directed to conduct research through its own facilities.

Three definitions are necessary for an understanding of a major portion of the act: "fissionable material," "source material," and "by-product material," defined as used in this Act.

Fissionable material: "plutonium, uranium enriched in the isotope 235, any other material which the Commission determines to be capable of releasing substantial quantities of energy through nuclear chain reaction of the material, or any material artificially enriched by any of the foregoing; but does not include source materials."

Source material: "uranium, thorium, or any other material which is determined by the Commission, with the approval of the President, to be peculiarly essential to the production of fissionable materials; but includes ores only if they contain one or more of the foregoing materials in such concentration as the Commission may by regulation determine from time to time."

By-product material: "any radioactive material (except fissionable material) yielded in, or made radioactive by exposure to, the radiation incident to the processes of producing or utilizing fissionable materials."

The Commission is by this Act the exclusive owner of fissionable material production facilities, with the exception of those used in research and development in the fields previously specified and which do not have, in the Commission's opinion, adequate facilities for the production of enough fissionable material for the construction of an atomic weapon. The Commission is authorized to provide for the production of fissionable material in its own facilities and to enter into research and development contracts for the production of fissionable material in Commission-owned facilities. Any such contract shall prohibit any sub-contracting with-

out Commission-authorization and shall obligate the contractor to make reports to the Commission, to submit to frequent inspections, and to comply with all safety and security regulations set by the Commission.

Unless licensed by the Commission, "no person may manufacture, produce, transfer, or acquire any facilities for the production of fissionable material." These licenses are issued "in accordance with such procedures" and "upon such conditions" as the Commission establishes.

Ownership of Fissionable Material

Perhaps the most discussed section of the Act is that which gives to the Commission all rights within the jurisdiction of the United States to any and all fissionable material in existence or to be produced. This section makes it unlawful for any person to possess any fissionable material unless authorized by the Commission, or to export from or import into the United States any fissionable material. The Commission is, however, authorized to distribute fissionable material, upon request, for such purposes as the conduct of research or development activities or medical therapy. The Commission is prohibited from distributing such material in quantities sufficient for the construction of atomic weapons.

Another section of the Act prohibits the transportation of any source material unless licensed by the Commission. The standards and procedures for the issuance of such licenses are established by the Commission. All source materials on any public lands are reserved for the use of the United States subject to valid rights existing on the date of enactment of the Act (Aug. 1, 1946). The Commission is authorized to "purchase, take, requisition, condemn, or otherwise acquire" supplies of source materials or any interest in property containing deposits of source materials.

The Commission is authorized to distribute by-product materials for such uses as research and development, medical therapy, or industrial purposes. The Commission is expressly prohibited from distributing any fissionable material to any foreign government.

With respect to military applications of atomic energy, the Act provides for the Commission to conduct research and development work in the military application of atomic energy and to engage in the production of atomic weapons. The latter activity requires the annual consent and direction of the President.

This Act makes it unlawful "for any person to manufacture, produce, or export any equipment or device utilizing fissionable material or atomic energy, or to utilize fissionable material or atomic energy with or without such equipment or devices" unless licensed to do so by the Commission. When the Commission decides that any non-military use of fissionable or atomic energy has been "sufficiently developed to be of practical value" it shall submit a report to the President stating all the facts along with the Commission's estimate of the social, political, economic, and international effects of such use "and the Commission's recommendations." This report together with the President's recommendations is then sent to Congress. The Commission cannot issue a license until after such a report has been filed with Congress and "a period of ninety days in which Congress was in session has elapsed." With the fulfillment of these two provisions the Commission may license such use in accordance with such conditions and procedures as established by the Commission. Each license will be renewable at the end of a specified period. The Commission has the authority to revoke a license at any time.

A provision is made to the effect that any "treaty approved by the Senate or international agreement hereafter approved by the Congress" takes precedence over this Act.

Control of Information

Lengthy provisions are made for the control of information, especially that on "restricted data." As used in this Act, "restricted data" means "all data concerning the manufacture or utilization of atomic weapons, the production of fissionable material, or the use of fissionable material in the production of power, but shall not include any

data which the Commission from time to time determines may be published without adversely affecting the common defense and security." Penalties are provided upon conviction for several crimes, including communication or acquisition of restricted data. Capital punishment may be enforced, but only upon recommendation of the jury and only in cases "where the offense was committed with intent to injure the United States." No arrangements, contracts, or licenses may be made or issued without an agreement in writing by the applicant "not to permit any individual to have access to restricted data until the Civil Service Commission shall have made an investigation and reported to the Commission on the character, associations, and loyalty of such individual and the Commission shall have determined that permitting such person to have access to restricted data will not endanger the common defense or security." Similar provision is made for employees of the Atomic Energy Commission.

Effect on Patent Rights

From the date of enactment of this Act, no person could obtain rights by a patent to any invention or discovery insofar as it would be used in the "production of fissionable matter or in the utilization of fissionable matter or atomic energy for a military weapon." Any such rights held by virtue of previous patents were at the same time revoked. Any person who makes an invention or discovery useful for the two previous applications is directed to file a report with the Commission, containing a complete de-

scription of the discovery or invention. This report is to be filed within sixty days after the completion of the discovery or invention, or within sixty days after such person "first has reason to believe that such invention or discovery is useful in such production or utilization," the later date being the limit date.

The Commission has as a duty the declaration of any patent "to be affected with the public interest" if that which is patented either "utilizes or is essential in the utilization of fissionable matter or atomic energy" or the licensing of such materials is "necessary to effectuate the policies and purposes of this Act." When such declaration has been made, the Commission or anyone licensed by the Commission is authorized to use the patent. The owner of the patent shall receive a "reasonable royalty fee," to be agreed upon by the owner and the licensee, or by the Commission. To carry out this latter duty, the Commission is directed to set up a Patent Compensation Board. Any person not satisfied with this board's decision may obtain a review of the decision in the Court of Appeals for the District of Columbia.

Powers of the Commission

To perform its functions, the Commission is authorized to hold investigations and hearings as it may deem necessary to carry out the provisions of the Act. The Commission is granted the usual investigating-committee powers, such as the right to administer oaths, issue subpoenas, etc. Furthermore: "the Commission is authorized . . . by subpoena to require any person to

appear and testify, or to appear and produce documents, or both, at any designated place. No person shall be excused from complying with any requirements under this paragraph because of his privilege against self-incrimination, but the immunity provisions of the Compulsory Testimony Act . . . shall apply with respect to any individual who specifically claims such privilege." The Act referred to states that no person can be prosecuted or subjected to any penalty for anything which he may testify or produce while claiming immunity under this act.

The Commission is empowered to determine the compensation to be paid for any property or other interests taken by authority of this Act. Any dissatisfied person is entitled to sue the United States in the Court of Claims or in any district court of the United States.

The Commission is empowered to make arrangements and contracts without the advertising of bids if, in the opinion of the Commission, "such action is necessary in the interest of the common defense and security or upon showing the advertising is not reasonably practicable."

The Commission is directed to submit to Congress, in January and July of each year, a report concerning the activities of the Commission. Finally the Act establishes a Joint Committee on Atomic Energy, composed of 18 members of the House and the Senate, whose duty is to "make continuing studies of the activities of the Atomic Energy Commission and of problems relating to the development, use, and control of atomic energy."

The Eventful Life of the Technical Editor

by HOWARD J. SANDERS, Chem.E. '47

Had it not been for the continuing publication of hundreds of technical periodicals both in this country and abroad, the growth of science and engineering during the past half-century would have been severely stifled. The development of both science and engineering depends vitally upon the free exchange of ideas through the medium of technical publications. Thanks to the widespread distribution of the printed word, technical problems already solved do not have to be needlessly repeated, for the answers, for the most part, are already in the literature. The researcher who follows the current literature knows, often quite specifically, the limits of present knowledge. He can take it from there—

and thus make his greatest contributions to his chosen field.

Of particular importance, the periodical literature provides continual, fresh stimulation. Ideas originating in one area of research often have a startling way of being just as applicable in totally unrelated fields. Scientists, therefore, are ever on the lookout for new ideas that may perhaps one day have a direct bearing on their own work. Certainly, the vast readership commanded by the technical magazines of our day is evidence enough of the major role these publications play in the development of the professional man.

As the well-laden shelves of engineering libraries clearly indicate, every branch of engineering today

has at least one or more magazines that specifically serve that field. Some of these publications may be devoted to only one small segment within a particular area of engineering, while others may cover the field quite broadly. The individual who must keep continually abreast of the times may read or scan dozens of these publications.

Serving the needs of scientists and engineers are the editors of these technical periodicals. The men and women whose names appear in fine print on the contents pages of these journals are among the nation's most potent forces in science and engineering. They are the people who decide which technical findings will appear in print and thus influence the thinking of perhaps tens of thousands of readers. They are the people who decide what is news. Their job is to determine the events of the day that are of outstanding significance—and to highlight these events with word and picture. Their job is to interpret the news so that not only does it have meaning for the experts but also for those whose present interests may be far removed.

Each year, a small but important segment of the nation's scientists and engineers enter the field of technical writing. Their work may fit into any one of a variety of categories. Many in this group become specialists in the editing and writing of the highly technical reports

In connection with a forthcoming article on the current farm situation, members of the American Chemical Society's editorial staff interviewed Secretary of Agriculture Ezra T. Benson (right).



needed in industry, in universities, and in government. Others become involved in the preparation of promotional bulletins, magazines, and press releases issued by private companies. Others, in increasing numbers, become editors of technical magazines published by professional societies or by commercial publishing firms.

Job Requirements

The young man who has long had a keen interest in writing, plus a real enthusiasm for science or engineering, may possibly have considered making a career as an editor of one of these publications. His first question, of course, is: What's it like? Will I have to be old and venerable before I can make the grade? Do I have to become an expert first? Should I work in industry for several years before tackling editorial work? Do I have to take extra English courses? Must I be a brilliant writer?

Before any attempt is made to wrestle with the first question, let's get to the others. What about age requirements? Actually, many people now carrying important responsibility in the field of technical editing are relatively young. Many are in their twenties and thirties. For the person ready to start out as an editorial assistant or as an assistant editor, youth is seldom a handicap.

Although broad familiarity with a particular phase of science or engineering is certainly desirable, the editors of technical publications make no pretext of being experts in all fields covered by their publications. Technology has become much too complex for that. It is the rare editor who can expect his assistants to be walking encyclopedias. In the field of technical writing, what is more important than an unlimited fund of knowledge is a logical, inquisitive mind. A man must be able to get the facts, to interpret them, and to present them concisely and clearly.

If the staffs of most of today's technical publications are any guide, the editors of these magazines definitely expect new employees to have had at least some industrial experience. The usual requirement is from three to five years. The reason is clear enough. For a man to write intelligently in

a given field, he should have had at least some first-hand experience with it. The broader a person's industrial experience can be, the better.

What about English courses and the ability to write with the master's touch? In general, the English courses provided in a standard engineering or scientific curriculum are adequate. A few extra courses in writing would naturally be helpful but are not essential. Moreover, it is generally agreed that the person who plans to enter technical writing does not have to be too deeply concerned about his prowess as a creative writer. The job of the technical editor, first and foremost, is to provide information. He should be able to write accurately, understandably, and readably. High-flown prose is clearly out of place.

The average editor looking for a new assistant is mainly interested in the man's technical competence rather than in his skill as a writer. That is why editors of scientific and engineering publications look to the graduates of the technical colleges rather than to those of schools of journalism for prospec-

tive staff members. On the other hand, editors of company magazines often prefer to start with a man who is primarily a writer and let him pick up the necessary technical know-how along the way. Usually, this works out well enough, mainly because the technical requirements of company publications are not nearly so demanding as those for magazines that serve fields of science or engineering.

Editor's Activities

Now for that all-important question: What's it like to be a technical editor? First of all, technical editing is an extremely varied experience that defies simple description. One of its major fascinations is its variety, its continual change. The job is as diversified as the content of the morning newspaper.

For example, the editor of a chemical publication may one day be in Niagara Falls, N. Y., attending a press conference on a new insulating material. The next morning, he may be back at his desk putting the finishing touches on an article on the latest synthetic fibers. That afternoon, he may be attend-

About the Author



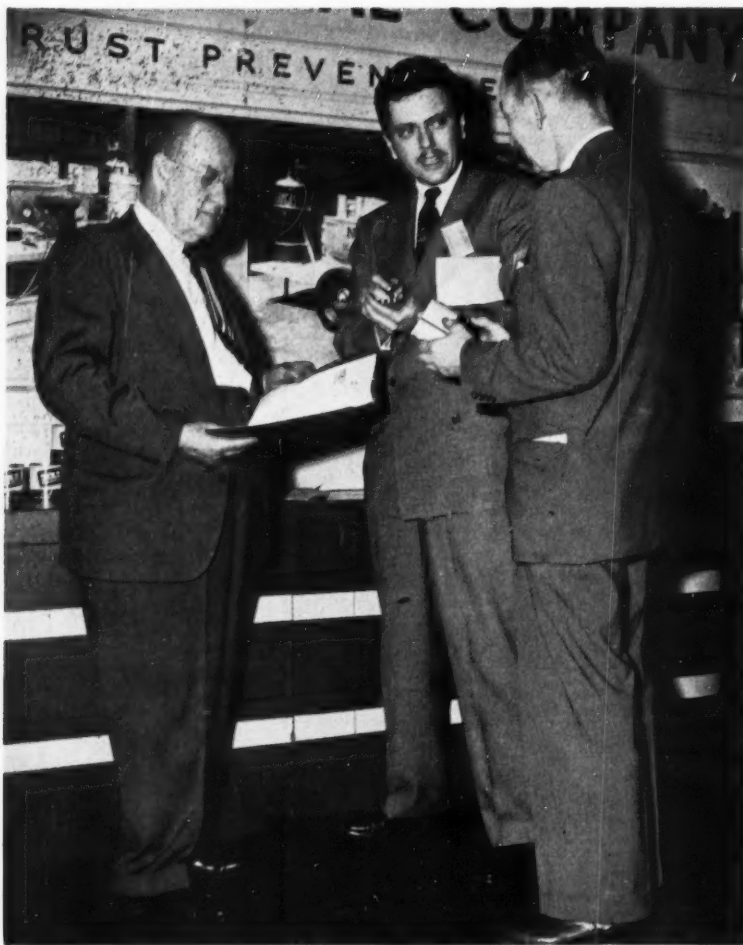
Howard J. Sanders

Howard Sanders is no newcomer to these pages. A former member of THE CORNELL ENGINEER editorial staff, he has at various times written articles for the ENGINEER on such subjects as television, shrink-resistant wool,

industrial training programs, and underwater welding. While at Cornell, he was awarded two of the University's top essay prizes.

Upon graduation as a chemical engineer in 1947, he joined the American Cyanamid Co. at Bound Brook, N. J., where he served as a member of the process development department. In 1950, he moved to Washington, D. C., to join the editorial staff of several of the magazines published by the American Chemical Society. Two years later, he was transferred to the ACS editorial office in New York, where today he is associate editor of Chemical and Engineering News, Industrial and Engineering Chemistry, and Journal of Agricultural and Food Chemistry.

Over the years, Sanders has written for such magazines as Product Engineering, Metal Finishing, and Sky and Telescope. Condensations of his articles have appeared in Science Digest, Newsweek, Harvard Alumni Bulletin, and Chemical Trade Journal of England.



At the Chemical Exposition, associate editor Merritt L. Kastens (center) discusses new technical developments with two of the exhibitors in preparing his report for "Chemical and Engineering News."

ing a meeting of cosmetic chemists, while someone back at the office is making hotel reservations so he can attend an out-of-town meeting on coal hydrogenation the following week.

During the course of a month, a science editor may spend a large share of his time attending technical meetings. On the basis of his reports, readers are informed of the highlights of important scientific developments within just a few days or weeks after they are announced in formal technical papers. Otherwise, readers might be obliged to wait months before these papers are published in full.

One of the most challenging jobs of the technical editor is the writing of feature articles. Usually, articles of this type are based mainly on interviews and correspondence. In gathering his information, the

editor may travel extensively. He may talk with dozens of authorities in the field before he will even attempt a preliminary draft of his report. In this way, he gets his facts first-hand, combined with that vital human touch.

In the preparation of technical reports, immensely more fact-finding is usually required than might be imagined. Sometimes, months of work may be required. The literature already available must often be thoroughly combed. Not long ago, a technical editor preparing an article on the nation's water resources amassed such a huge collection of literature on the subject that, when a government agency began its own survey in this field, it received permission to borrow an entire filing cabinet full of his source material. In all fairness, however, it must be stated that this

is not a typical case.

Among the many different types of articles written by technical editors are those dealing exclusively with the operations of a single industrial plant. In gathering his facts, the editor may spend several days or even weeks visiting the plant to become thoroughly familiar with its operations. Quite possibly, he may be one of the very few outsiders ever permitted inside the plant. He will talk with the plant operators, the research people, the engineers who designed the plant. Frequently, he also confers with the president of the company. As he discovers with considerable satisfaction, the position of editor is a ready entree to people and places he might never have known otherwise.

To be sure, not all articles in technical publications deal with facts alone. Many are designed primarily to give the reader a cross section of current opinion in a particular field. For example, a magazine may wish to provide its readers with a personalized, up-to-the-minute picture of the current and future status of a given industry. In the preparation of such an article, dozens of industrial, university, and government leaders may be interviewed. Executives may be asked, in particular, to discuss major trends in the industry. Their opinions must then be carefully sorted, evaluated, and finally presented for publication.

Further Duties

Of course, the editor is concerned not only with writing articles himself but also with getting others to write articles for his publication. This is at all times not only a very vital undertaking but often a very delicate one. The editor must choose someone who knows his subject well and can effectively communicate his ideas to others. He must select a person who not only has the facts but who also has a sense of the significance of his own field. At the same time, the selected author must be a person who can view his subject in such broad perspective that he does not become hopelessly lost in a welter of detail.

A few of the activities of the technical editor have already been

mentioned. There are many more. He helps to make decisions of broad editorial policy. He attempts to answer the steady flood of inquiries from readers. He has an insatiable demand for illustrative material, particularly photographs. He is concerned with type faces and page layouts. He reviews and edits manuscripts. He is ever on the watch for new, unannounced developments. (Will that Philadelphia company finally buy out its long-time competitor in New Haven? Has Dr. Wallingford really discovered an effective new polio vaccine? How has the demand for that new insecticide been affected by the sudden drop in price?) The editor, looking always for the meaning behind the events, thrives on news.

Actually the day-to-day work of every technical editor is not nearly as broad-gauge as has here been indicated. Most scientific publications are relatively limited in their editorial coverage, particularly since many consist almost exclusively of contributed articles. The editor of such a magazine may spend a major share of his time simply in editing the articles submitted by outside authors. Many magazines published by professional societies, for example, consist largely of reports presented by the members at technical meetings. Over these articles, the editor often has very little control.

But times are changing. To an increasing extent, technical publications are tending to favor staff-written or at least staff-initiated articles. The editor recognizes an important technical development and he writes about it or he gets someone else to write about it. He does not merely wait for the article to turn up fortuitously in the morning mail. He knows what kinds of articles he wants and he goes after them.

Furthermore, he knows what articles, because of their mode of presentation, are readable and which are not. He knows that great numbers of scientists and engineers are not fluent writers and that their material will not be read, except by a select few, unless deliberate efforts are made to convert ponderous prose into something that will excite a reader's interest. This emphasis on readability is a significant

development in the field of technical writing, for it means that, increasingly, editors will be taking a firmer hand in the molding of the material that enters their publications. This will also mean a steadily increasing demand for the skills of technical writers—and greater opportunities for service.

Varied Compensations

Especially impressive to the technical editor is the enthusiasm with which others give their time and talents to the service of scientific publications. Non-staff members not only write articles and serve as sources of information but also act as manuscript reviewers and members of editorial advisory boards. Busy research directors are ready to spend hours with an editor, if necessary, to supply the facts he is seeking. A company president, very helpfully, may write voluminous letters in reply to an editor's detailed inquiries. All this is done without any thought of remuneration. A technical publication would quickly cease to exist if it attempted to repay even a small percentage of the people who render it invaluable service. The persons who contribute their special skills to technical publications do so because they know the value of such jour-

nals in the continuing development of science and engineering.

Technical writing is stimulating work. It has many rewards. The greatest of these is people—the people you meet. In the course of a month, you may get to know a Nobel Prize scientist, a director of research of a leading chemical firm, the president of a university, the head of a foreign technical society, and a laboratory researcher doing important work on a new arthritis drug. Often these people are met just at the moment when they are making headlines.

The editor enjoys other rewards, such as receiving a cordial letter from a reader in British East Africa requesting additional details about an item he wrote several weeks before. Or a company, wishing to distribute his article more widely throughout the industry, may order 5000 reprints. Or someone may phone in to say that last week's news story provided exactly the information he required.

The editor has the satisfaction of knowing that he is helping to keep others informed. By transmitting the facts as accurately and as fully as possible, he is directly influencing the thoughts and actions of others. In this way, perhaps he, too, is helping to make the news.

Discussing a chemical engineering flow sheet for a forthcoming plant process article for "Industrial Engineering Chemistry" are William L. Hull (left), and Gordon H. Bixler, members of the American Chemical Society's editorial staff in San Francisco.

—Cliff Bond



Rocket Research

Prelude to Space Travel

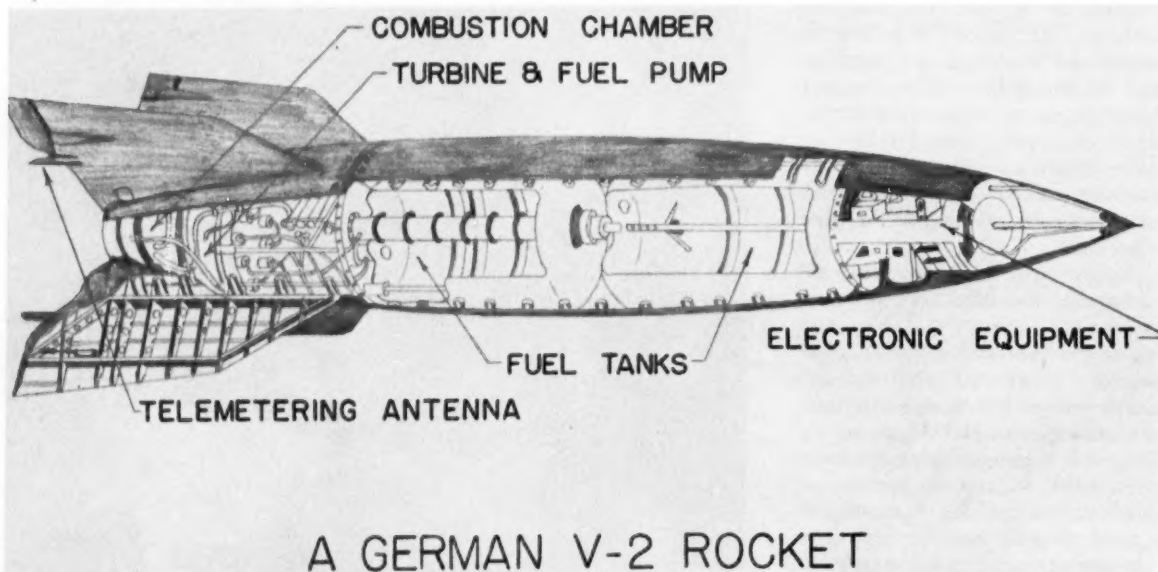
by RICHARD BRANDENBURG, EP '58

New York City's Hayden Planetarium has a file bulging with the names of more than 24,000 eager individuals who want to go along on man's first journey into space. Applicants range from eighty-five year old woman who suggests the space ship be built in a hurry because she is getting old, to a sixteen year old who argues his age and nerve will make him a logical choice for a seat on the first space-rocket. There are letters from fur brokers who want fur trading rights on the planets, insurance salesmen who want to handle space travelers' insurance, and contractors who want options for home construction on Mars. There is even a letter from a soldier who wants to spend his honeymoon on the moon. Each name is being recorded and the applications are being stored in an airtight vault for future reference. Public enthusiasm toward interplanetary flight is reflected not only in the sincerity of this collection of applications, but in the number of radio and television programs, mag-

azine articles, movies, and science fiction publications, which have made space travel a common term. The possibility of space flight has stimulated the public's imagination in spite of the engineering obstacles that must be overcome. The magnitude of technical problems and the present efforts to remove the barriers to travel in space are overlooked in the rush of elaborate colorful conjecture about luxurious stations in space and complex journeys to the moon.

Beginning efforts toward the achievement of space flight were made in Germany in the early 1930's. The German V-2, developed as a military necessity, integrated the solutions to many rocket problems into a workable machine. It provided the foundation for present rocket research trends. Work on the V-2 began in 1933 with the development of the four-and-one-half foot long A-1 rocket. The A-1 was an attempt to collect engineering data supplementing the initial research published in 1929 by Professor Her-

mann Oberth on the theoretical aspects of space travel. The A-1 was used as a test stand and never left the ground. A year later, the A-2 was constructed along the lines of its predecessor and was fired to a height of 6000 feet. The A-3 followed, having a length of twenty-five feet, a weight five times that of the A-1, and a series of internal vanes placed in the path of the exhausting fuel gases for rocket control. The next step, the construction of the A-4 or V-2 rocket, was preceded by the design of an A-5 rocket to test control devices and the use of peroxide for steam generation essential to the operation of fuel pumps. The V-2 was ready for the first flight tests in 1942, and although those first tests were erratic, the machine itself remained a stirring tribute to German scientific ability and imaginative engineering skill. The twelve years of effort spent by the Germans in developing the V-2 were pioneering years in rocket design. The accomplishments are reflected in the ap-

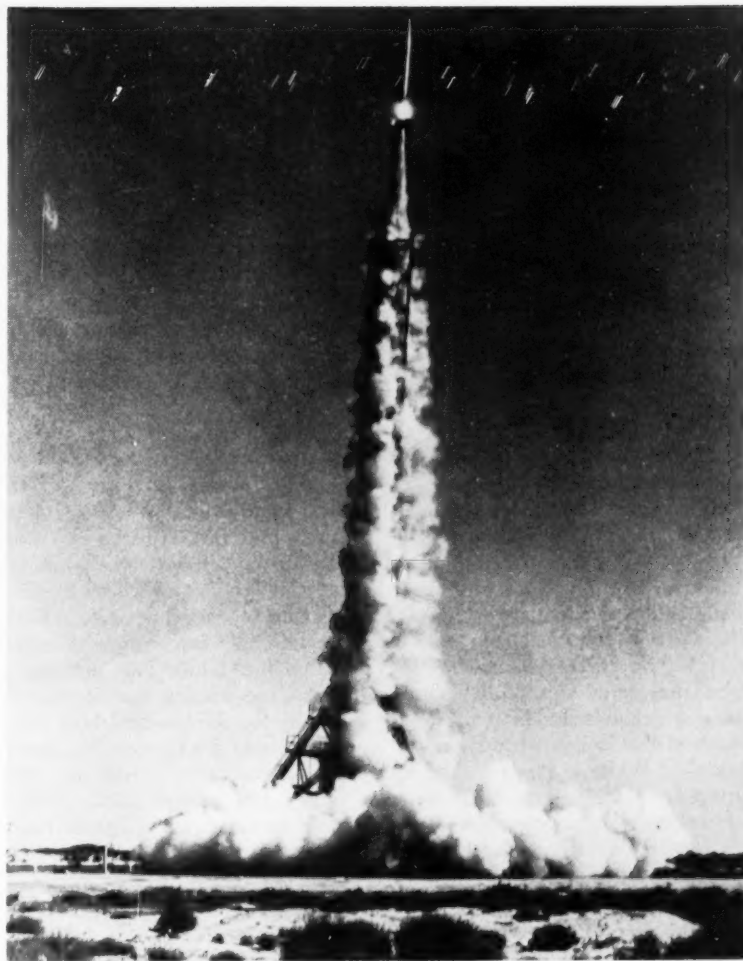


plication of the basic features of V-2 construction in American research rockets.

Research in the United States

The Martin Viking is an example of improvement upon the V-2 in liquid-fuel rocket design. The Viking, almost as long as the V-2, is thinner, weighs half as much, and utilizes the same general power-plant system as its German predecessor. However, basic differences include the use of integral fuel tanks whose shells are formed by the skin of the rocket itself. The motor of the Viking is pivoted by a gymbal-ring arrangement, so that directional control is achieved directly by varying the line of thrust. Original Viking designs included the use of steam jets in the sides of the rocket which corrected unnecessary roll by releasing varying volumes of steam from the vents. Another American design is the Aerobee, a smaller liquid fuel rocket, developed by Johns Hopkins University. The Aerobee is propelled by a jettisonable booster to a speed of about 1,000 feet per second, after which it continues to an altitude of seventy-two miles with a payload of one-hundred-and-fifty pounds. A third simpler American design is the seven-hundred-pound Wac Corporal. The Wac has no control system except vanes for stabilization, and is capable of reaching a peak altitude of over forty-three miles. The Wac Corporal holds the altitude record for a man-made machine, having been sent to an altitude of two hundred forty nine miles by a V-2 used as a booster. This historic flight was made on February 24, 1949, and was a significant preview of man's conquest of space.

An insight into present rocket development can be obtained by examining the work of the Air Force Missile Test Center at Cape Canaveral, Florida, and the Holloman Air Development Center near Alamogordo, New Mexico. Potentially, a rocket launched from the Missile Test Center's concrete launching pads on the Florida coast at Cape Canaveral could pass over the Bahamas, the northeast corner of Brazil, the Atlantic, the southern tip of Africa, and finally travel half way around the world to Australia. Today, however, mis-



A rocket of the Aerobee type being launched at White Sands Proving Ground.

sile ranges are limited to around two hundred miles. Cape Canaveral was selected as a test center because of the possibility of year-round operation in the Florida climate and the availability of cheap uninhabited land near an abandoned naval air base that could be used as a center of operations. Treaties were made with Britain and with several Central American countries to make possible efficient operation of the test center. Teams of trained men were sent through the islands to educate the natives in the area about rocket and guided missile flight. The team carried charts, models, and an operating missile mock-up from village to village as they sought essential cooperation from the inhabitants of the islands in the test area.

Safety and exact timing mark the nature of a typical test pro-

gram at Cape Canaveral. Launching of a missile is usually scheduled during the last few hours of daylight, when the sun does not affect observers and optical missile-tracking equipment. Prior to launching, a group of bombers thoroughly covers the area, warning ships, small boats, and other aircraft to steer clear of the test region. Jet fighters, used for chase and guidance, are poised to destroy the missile in flight if something goes wrong with the test program. Take-off is photographed by a battery of special cameras, and the course of the missile is controlled by automatically plotted radar data. Photographic plotting indicates the missile's position to within fifty feet over a fifteen mile range. Data gained from comprehensive missile tracking is punched on tapes and fed into electronic computers for evaluation. Tests at Canaveral are

not only valuable to missile manufacturers, but provide essential information on operation of the test range as well. The long-range missile testing program is a concrete, specific step toward the ultimate achievement of space travel. The men of the Air Force Missiles Test Center deserve more recognition for their achievements than the dreamers who conjure up vast images of space-going luxury liners.

Holloman Air Development Center, located near the site of the first atomic bomb test in New Mexico, is also making practical contributions toward the conquest of space. Here engineers and scientists are testing a variety of projects, including balloons, rockets, guided missiles, parachutes, and drone aircraft. Since it was initiated in 1947, Holloman has become a busy base that handles as many as sixty missile tests a month. The area is bounded on three sides by mountains that form a natural channel along which missiles may be fired. South of the Holloman range is the Army's White Sands Proving Ground, where German V-2's have been exhaustively evaluated. Tests are conducted in cooperation with the Army, by sharing responsibility for missile recovery, instrumentation, safety, and scheduling. Holloman extends a helping hand to private companies who desire data from a test of their missile. The private concern moves in as a tenant, and is provided with space, transportation, and aid in program planning by Holloman personnel.

Test Methods in Research

Studies of the upper atmosphere by liquid fuel research rockets yield useful information about a variety of high altitude phenomena. For instance, the nose section of the V-2, formerly used to house a warhead, has been converted to contain devices to measure skin temperature, air pressure, internal temperature, cosmic ray intensity, and high altitude ionization. In addition, rocket performance is measured by gauging pressure in fuel tanks, pressure in the combustion chamber, and the speed of the fuel pump machinery. This information is relayed to earth by an internal radio transmitter, capable of sending data over twenty different channels. Re-

search rockets are also used to make spectrum records, record air density, take gas samples, and test the effects of the upper atmosphere on living organisms. Monkeys, fruit flies, and seeds have been sent aloft to determine the effects of weightlessness, extreme temperatures, and cosmic ray damage to genes. Rockets carrying cameras aloft have recorded pictures of the earth at high altitude, providing information not only about rocket trajectories but about the nature of certain cloud formations and their effects on the weather as well. To gain exact information about the actual flight behavior of a given missile, several methods are used simultaneously to track the missile after it is launched. Radar impulses, sent from a nose transmitter and reflected from tail surfaces, are supplemented by photographic and optical checks through the use of the German Askino theodolite. This instrument allows the rocket to be tracked visually for one hundred fifty miles, and records flight path by means of a camera, operating at sixty frames per second. Still another method uses radio signal transmitted from a unit in the rocket's nose. The relative frequencies of the impulse as the rocket travels farther away from its launching point are calculated to determine the position of the missile. Each phase of the research carried on by present rockets yields new knowledge about the mysteries of upper air conditions and rocket flight problems.

A comparison of the present achievements of unmanned rockets with the requirements that must be met for manned space flight indicates that considerable research must be devoted to the human factor of space flight. The answers to the physiological problems of supersonic airplane flight can be applied in many respects in preparing man for space travel. Tests have been conducted with human subjects in "hot boxes" to determine effects of extreme temperatures, in centrifuges to test high accelerations, in pressure chambers to study human reaction to a rarified atmosphere, and in devices that gauge the body's balancing mechanisms and its adjustment to high frequency vibrations. In addition

to these high speed flight problems, men in space will encounter solar radiation, cosmic rays, soft x-rays, meteors, weightlessness, disorientation, and psychological boredom. Each of these conditions requires thorough research, and definite counteracting measures before space flight can be successful. However, present accomplishment is often overlooked in the flurry of emphasis upon the weird effects of mysterious outerspace phenomena, or in the equally misleading attempts to gloss over the human factor as a secondary problem that is almost completely solved.

Other Barriers to Space Flight

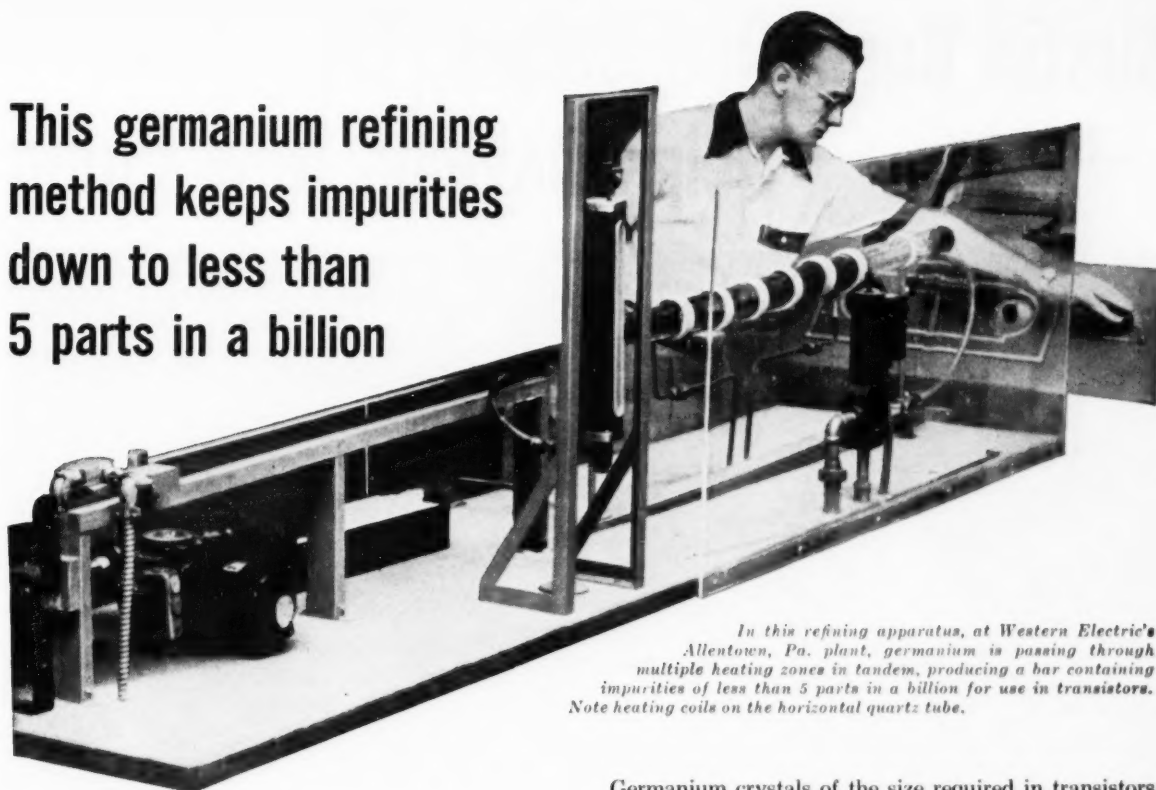
A brief survey of the engineering problems that must be overcome in the conquest of space includes many factors in the realm of chemistry. The efficiency of the use of liquid fuels at present is low, as indicated by the fact that only 55 per cent of their ideal exhaust velocity can be achieved. The limiting factors of temperature and pressure in combustion chambers place a ceiling on exhaust velocities of liquid fuels that can be attained regardless of their chemical composition. The problem of metal alloys is reflected in the fact that in the V-2 the alcohol fuel had to be supplemented by water to prevent burnout in the combustion chamber. The problem of high temperature liners for combustion chambers must be overcome. Materials capable of withstanding great temperature fluctuations, chemical regeneration of a livable atmosphere in a space ship, and adequate control and guidance mechanisms are among the engineering problems that must be solved. The solution does not lie in luxury liners in space and trips to the moon. Rather, a well organized research effort with practical goals must lay the foundation for space ships and space stations.

A Look to the Future

Using present fuels, present materials, tested design methods, and moderate performance requirements, a manned research rocket could be constructed as an intermediate step between present rockets and potential space stations.

(Continued on page 36)

This germanium refining method keeps impurities down to less than 5 parts in a billion



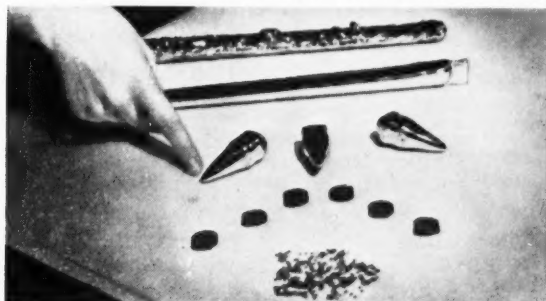
In this refining apparatus, at Western Electric's Allentown, Pa. plant, germanium is passing through multiple heating zones in tandem, producing a bar containing impurities of less than 5 parts in a billion for use in transistors. Note heating coils on the horizontal quartz tube.

A new method of metal refining, currently in use at the Western Electric plant at Allentown, results in the production of germanium that is better than 99.9999995% pure — the highest degree of purity ever attained in a manufactured product.

The need for germanium of such exceptional purity came about when research by Bell Telephone Laboratories in the field of semi-conductors led to the development of transistors, which are manufactured by Western Electric.

The transistor is a tiny crystal device which can amplify and oscillate. It reduces space requirements and power consumption to a minimum.

Various forms which germanium takes before being used in transistors are shown in this photo. Bar at top is an ingot of germanium after reduction from germanium dioxide. Next is shown the germanium ingot after the zone refining process used by Western Electric. Below the ingots are shown 3 germanium crystals grown by machine, 6 slices cut from these crystals, and several hundred germanium wafers ready for assembly into transistors.



Germanium crystals of the size required in transistors do not occur in nature; they are artificially grown at Western Electric. At this stage in transistor manufacture, other elements are introduced in microscopic quantities to aid in controlling the flow of electrons through the germanium. But before these elements can be introduced, it is necessary to start with germanium of exceptional purity, so that the impurities will not interfere with the elements that are deliberately added.

So Bell Telephone Laboratories devised an entirely new method of purification, known as zone refining, which was developed to a high-production stage by Western Electric engineers.

In zone refining a bar of germanium is passed through a heat zone so that a molten section traverses the length of the bar carrying the impurities with it and leaving behind a solidified section of higher purity. By the use of multiple heating zones in tandem, a number of molten sections traverse the bar. Each reduces the impurity content thus producing a bar which contains impurities in the amount of less than five parts per billion.

Because of the importance of the transistor in electronics, the zone refining process — like so many other Western Electric developments — has been made available to companies licensed by Western Electric to manufacture transistors.

This is one more example of creative engineering by Western Electric men. Engineers of all skills — mechanical, electrical, chemical, industrial, metallurgical, and civil — are needed to help us show the way in fundamental manufacturing techniques.



A UNIT OF THE BELL SYSTEM SINCE 1882

Manufacturing plants in Chicago, Ill. • Kearny, N. J. • Baltimore, Md. • Indianapolis, Ind. • Allentown & Laureldale, Pa. • Burlington, Greensboro & Winston-Salem, N. C. • Buffalo, N. Y. • Haverhill & Lawrence, Mass. • Lincoln, Neb. • St. Paul & Duluth, Minn. Distributing Centers in 29 cities and Installation headquarters in 15 cities. Company headquarters, 195 Broadway, New York City.

Austin Bush, Rensselaer, '50, Helps Develop New Pump



AUSTIN BUSH, inspecting stuffing box assembly on boiler feed pump.

Reports interesting project engineering assignments at Worthington

"Despite its size as the leading manufacturer in its field," says Austin Bush, "I have found Worthington pays considerable attention to the interests of the individual. The company's excellent training program consists of several months of working with the various types of equipment manufactured, augmented by technical lectures, and talks on the organization of the corporation.

"Following this training, I was given an opportunity to choose the department in which I wanted to work—engineering, sales, or manufacturing. My choice was

the engineering department where I have already been assigned to several interesting projects.

"In addition to the training program, the members of our engineering department hold monthly seminars at which engineering topics of general interest are discussed.

"Opportunities for advancement are good, and pleasant associates make Worthington a fine place to work."

When you're thinking of a good job, think *high*—think *Worthington*.

FOR ADDITIONAL INFORMATION, see your College Placement Bureau or write to the Personnel and Training Department, Worthington Corporation, Harrison, New Jersey.



2.54X

Prominent Engineers

Dick Conway

Thick glasses, a wan face, and a weary tread are the trademarks of an engineer with a ninety average in the eyes of most undergraduates. Richard Walter Conway, M.E. '54, completely defies this tradition (he wears no glasses, has a cheerful, ruddy face, and a springhly walk) and has managed to accumulate an average of 92.69 in his eight terms in the University to lead his class by a wide margin.

Dick graduated from Whitefish Bay (Wisc.) High School in 1949 with his sights set on industrial engineering, and in pursuing this course of study he has left behind him a believe-it-or-not story. He won h's numerals on the freshman rifle team and continued shooting during his sophomore year. The following fall he switched to crew and last year rowed No. 2 on the varsity 150's. For additional diversion Dick has played the trumpet in the Big Red Band, the Concert Band, and the University Orchestra. He is also a member of ASME and is active in CURW, having been co-chairman of the Living Units Speakers committee in preparation for last year's Campus Conference on Religion.

To occupy any other spare time he might have had, he has been historian, rushing chairman, vice president, and president of his fraternity, Alpha Delta Phi. Like all good engineers, he has spent a good share of every exam week taking his 1941 Buick apart—for aesthetic reasons.

In recognition of his achievements Dick has been elected to Pi Tau Sigma, Kappa Tau Chi, Tau Beta Pi, and Sphinx Head. When entering Cornell he was awarded a McMullen Scholarship and now holds the American Brake Shoe scholarship for his class.

Dick married Edy Davies, presently enrolled in the school of Home Economics, last August 29th, and is now an instructor, teaching Ac-



Dick Conway

counting 3231. When Dick graduates this June he plans to remain at Cornell for a year to teach and do some graduate work in the field of operations research, a brand new field developed during the war. Operations research deals with the application of the scientific method to the analysis of operations and is used as a guide to decision-making. It attempts to make common sense

Jack Brophy

—Matthew Starr



out of situations involving vast numbers of variables, a situation where common sense tends to be more of a well calculated guess.

After a year of grad school Dick's plans become a bit hazy, but it's safe to say that the class of 1954's King Midas will make a success of whatever he touches.

Jack Brophy

The fall of 1949 saw the entry into Cornell University of Jack Brophy, a lad that was to win his laurels by entertainment rather than by meteoric academic achievements. John Osborne Brophy, M.E. '54, graduated from Kent and came to Ithaca from Pelham, N.Y., with a talent for engineering and music as well as a legendary sense of humor. He won his numerals in tennis his freshman year but since then has concentrated on the Glee Club, Savage Club, and Cayuga's Waiters. Last spring Jack was elected leader of the Waiters, an autonomous triple quartet composed of members of the Men's Glee Club. Under his direction the Waiters have put out a new 10-inch long-playing record of their most popular numbers and have spent a week in Bermuda during Christmas vacation entertaining at the Castle Harbor Hotel. Jack is a soloist with the Glee Club and plays the sax, bass, and piano in addition to singing for Savage Club audiences. As a result of his fine work he has been elected to membership in Quill and Dagger.

Jack, a member of Sigma Phi fraternity and at one time a pledge-master there, is now a counselor in Cascadilla Hall. Being in NROTC, he has spent one summer on a Navy cruise, another designing and constructing machine templates for use in factory layout.

Jack's plans for future years do not extend beyond his tour of duty with the Navy, but with his resilient sense of humor they are bound to be enjoyable.

Successful designs must have
low manufacturing costs.

HOW TO CUT COSTS WITH WELDED PRODUCT DESIGN

LOW manufacturing costs are a "must" in today's product planning. As a result, every engineer must know, above all, how to eliminate needless cost in machine designs.

First consideration in designing machinery must be the material used. Steel is three times stronger, twice as rigid as cast iron, yet costs only a third of the price of gray iron.

That's why machine parts built with welded steel designs often cost 50% less to produce.



Fig. 1. Original construction of gear case cover weighed 66 pounds... required milling of bottom edge for oil-tight seal with gear case.

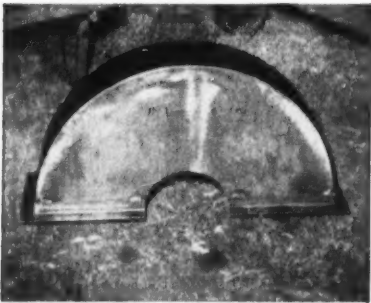


Fig. 2. Steel designed gear case cover now used weighs only 10 pounds... costs half as much to produce. Fabricated entirely in the manufacturer's own shop by arc welding.

Keep in step with the rapid progress in manufacturing with arc welding. Latest design developments are available in bulletins and handbooks that guide the engineering student. Write

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ARC WELDING EQUIPMENT

Hoboken Ferry

conducted by Bob Kantor

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1. An insect climbs up a hemispheric bowl. If the coefficient of static friction between the legs of the insect and the bowl is 0.30, how high can the insect climb?

2. Two boats are docked at opposite shores of the Hudson River. At a given instant the boats begin crossing the river, traveling at constant, though different speeds, in close parallel paths, and in a direction perpendicular to the two

parallel shores. When they meet, they are 1200 yards from the Jersey shore. The boats continue until they touch the opposite shore, whereupon they instantly reverse their direction, and begin traveling back on the same paths. When they meet again, they are 600 yards from the New York shore. How wide is the river at this point?

3. You are given 12 coins, 11 of which are good and one of which is counterfeit. They all look alike, but it is known that the counterfeit coin is either slightly heavier or slightly lighter. You have at your disposal a balance. With just three weighings on this balance, show how you can determine which coin is counterfeit and whether it is heavier or lighter than the others.

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were strictly
for the birds



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THE CORNELL ENGINEER

The Story of Our Engineering Council

by DAVID SCHERAGA, ME '54

The year was 1948. Visions of World War II were fading into the past, and things were rapidly returning to normal on the campus. Time-honored customs and traditions, which had fallen victim to the austere military atmosphere at Cornell during the war, were beginning to reappear.

It was at this time that a small, spirited group of engineering students decided to organize an engineering student council patterned after the one that existed in the days prior to 1941. From the efforts and inspiration of this group has grown the present Cornell Student Engineering Council, representing all the schools in the College of Engineering.

According to its constitution, the purposes of the Council are: "To coordinate the activities of the student organizations of the various schools in the College of Engineering; to provide a liaison between the undergraduates of the College of Engineering and the Cornell Society of Engineers; and to promote an esprit de corps, friendship, free exchange of ideas, and interest in the College of Engineering and the engineering profession." As can be seen, the avowed aims of the Council cover quite a bit of territory—in fact, all matters pertaining to the welfare of engineering at Cornell.

How well the Council has achieved its goals since its inception may be appreciated from the activities it sponsors each year. Instrumental in its plans to foster a spirit of unity among the engineers was the immediate reinstatement of Engineers' Day—another institution swept away in the wake of the war. The idea behind Engineers' Day was to stimulate interest in the various phases of engineering work and to give students and faculty alike a chance to demonstrate,

not without a touch of glamor, the latest developments of the present technological age.

The first program met with instant success, and "E-Day" has now become an annual event. Each year the doors of the engineering buildings are thrown open to thousands of visitors who come from miles around to witness first-hand the workings of engineering at Cornell.

Coordination of engineering society activities has been one of the chief concerns of the Engineering Council from the outset. It was recognized that close liaison with engineering student organizations would not only strengthen the student activities program, but would be an effective aid in making the Council more representative of student opinion. The recently completed \$1500 lounge in the basement of Sibley Hall will go a long way towards achieving this goal. It is planned to have all the engineering societies use the room for their meetings and social functions. The Council, which is responsible for management of the lounge, will

then work with the societies in planning their programs.

Underlying all of the group's activities has been the desire to achieve a better student-faculty-alumni relationship. Here again, the new lounge will be of great value as a convenient place to hold meetings, smokers, and parties. The Cornell Society of Engineers which donates a trophy each year for the best exhibit on display at Engineers' Day, maintains close contact with the University and takes an active interest in the affairs of the engineering college.

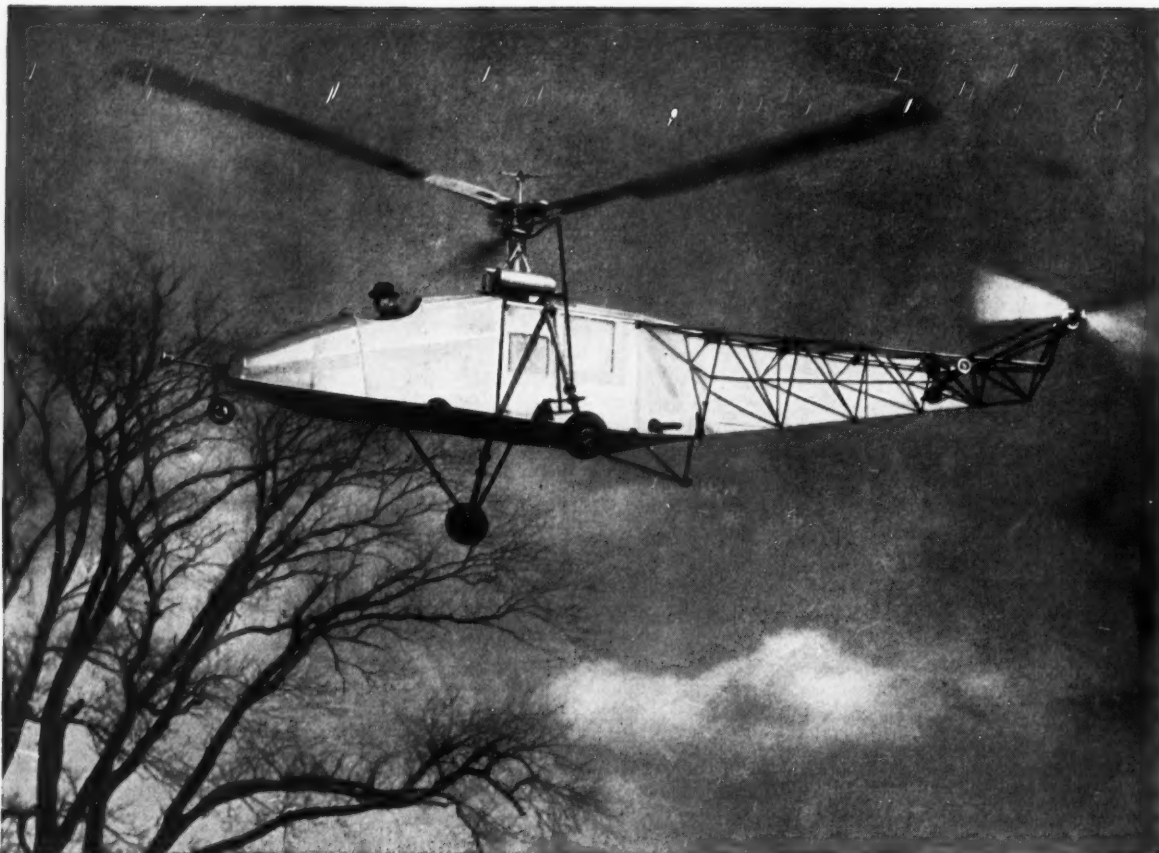
Questions are often raised as to the makeup of the Engineering Council. Originally it consisted of representatives from the engineering societies. However, this was subsequently altered to permit the entire engineering student body to participate in the election of council members. The group now consists of two elected representatives from each branch of engineering, one junior and one senior, as well as delegates from Tau Beta Pi and THE CORNELL ENGINEER. In addition, there is one faculty representative.

At present, one of the main objectives of the Council is to make itself better known and its purpose more thoroughly understood by the engineering student body. The broad scope of its activities, which have by no means been completely listed here, reaches every engineer at Cornell. It needs and deserves wide student support in order to perform efficiently the functions which make it such a valuable and necessary organization.

The 1953-54 Engineering Council in the new Sibley lounge. Seated: Mr. John McManus, Edward McDowell, Bob Fowler (pres.), Dick Wambach, Jan Button; standing: Len Mende, Pete Eberlein, Jim Weaver, Malcolm Davison, Bob Reddy, and Al Jacobs.

Matthew Starr





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COLLEGE NEWS

Perkins & Will Participates In Arch. School Project

A nationally known design firm has turned teacher for an experiment in architectural education at Cornell University.

Architects, engineers and other specialists from the staff of Perkins and Will have conducted the project for Cornell's College of Architecture. The object is to demonstrate how a modern "design team" attacks an architectural problem.

For the experiment, fourth-year students in design were set to work planning a junior high school building. The exercise is taking in all aspects of school design, from site planning to relations with the school board and the community.

Weekly reports by the students were criticized by the Perkins and Will specialists, who commuted to the campus in turn. In all, seven members of the firm took part in the exercise during the five weeks it continued.

Overall emphasis is on design "from the inside out," beginning with the effect of the school environment on the child and other basic factors.

To conclude the project, the class of 22 students spent January 16-19 in New York City, visiting new schools designed by several firms and observing a judging of plans submitted in a national school building competition.

Prof. Thomas W. Mackesey, dean of the college, described the exercise as an effort to give new dimensions to the teaching of design in keeping with the modern trend toward "architecture by team."

For a number of years the college has brought prominent practicing architects to its drafting rooms as visiting critics, but the experiment is the first attempt to use a firm as a whole.

Perkins and Will, with offices in Chicago and White Plains, is regarded as the country's leading design firm. The partners, Lawrence B. Perkins and Philip Will, Jr., are architecture graduates of Cornell,

as are two other members of the critic team, George A. Hutchinson and John Boyce.

Prof. Winter Appointed To Building Code Committee

Prof. George Winter of Cornell has been appointed to the American Concrete Institute's Standard Building Code Committee, whose decisions govern nearly all reinforced concrete construction in the United States.

The committee prepares and revises the Building Code Requirements for reinforced concrete,



George Winter

which are incorporated in almost all local, municipal, state, and federal building codes.

Professor Winter is head of the Department of Structural Engineering in the School of Civil Engineering at Cornell.

Prof. Detweiler Joins Archeological Group

Prof. A. Henry Detweiler of the College of Architecture at Cornell has been appointed architectural advisor to the American Academy in Rome for excavations at the site of the ancient city of Cosa.

The academy hopes to find evidences of Etruscan culture which was flourishing when the city was

conquered by the Romans in 275 B.C. Located on the western coast of Italy, Cosa was abandoned in the fifth century.

Prof. Detweiler is also chairman of the Jerusalem School for Oriental Research and has advised many Near East archeological expeditions.

Do You Know Any Prizewinners?

The Fuertes Alumni Medal Committee of the School of Civil Engineering would appreciate assistance in locating suitable papers to be considered for the Fuertes Alumni Medal. This medal is awarded annually by the faculty of the School of Civil Engineering to a graduate of that school or to a recipient of an advanced degree from Cornell (with the major in that school) for a meritorious paper on an engineering subject. This paper must advance the scientific or practical interest of the profession of Civil Engineering. Papers or books published by any agency during the year 1953 are eligible. Manuscripts scheduled for publication are also being considered.

Papers to be considered must be called to the attention of the Committee prior to April 15, 1954. Information concerning this award can be obtained from Professor Taylor D. Lewis, Chairman of Fuertes Alumni Medal Committee, Lincoln Hall, Cornell University.

Any information which will bring meritorious papers to the attention of the committee will be sincerely appreciated.

Tau Beta Pi Elections Announced

Twenty Cornell students—19 in the College of Engineering and one in the College of Architecture—have been elected to Tau Beta Pi, national engineering honorary society. They are the following:

Warren Breckenridge, Jr., ME '55; Sphinx Head Society, Cornell Daily Sun, Freshman Camp, Men's Glee Club.

Richard M. Eccles, ChemE '54; Intramural sports, University Orchestra, Inter-fraternity Council, Sage Chapel Choir, teaching assistant in chemical microscopy, President of Triangle social fraternity.

Earl R. Flansburgh, Arch '54; Phi Sigma Kappa fraternity, Gargoyle honorary society, Quill and Dagger, Red Key, Cornell United Religious Work secretary treasurer, Senior Class Council.

David L. Foss, ME '54; president Sigma Nu, captain ski team.

William I. George, ME '54; Captain of football team, Sigma Pi, Pi Tau Sigma, Quill and Dagger, Scabbard and Blade, Secondary schools committee.

Robert L. Hoepfel, EP '54; Dean's list two years, instructor in descriptive geometry.

John P. Jones, Jr., ChemE '54; President of Alpha Chi Sigma, Westminster Society, Dean's list four years.

Robert V. Kahle, ME '55; Cor-

nell United Religious Work vice-president, Secretary Men's Judiciary Board, Chairman of Bailey Hall Freshmen Orientation Show, Freshman Camp Counselor, Sphinx Head society, Pi Tau Sigma Outstanding Junior Engineer, Kappa Tau Chi vice-president, Chi Psi.

George T. Kraemer, EE '54;

Eugene A. Leinroth, Jr., ME '54; Society of Automobile Engineers chairman, Social committee chairman of Men's Class Council, Delta Tau Delta corresponding-secretary and vice-president, Kappa Tau Chi, Pi Tau Sigma corresponding-secretary.

Robert C. Marshall, ME '54; Pi Kappa Alpha, Pi Tau Sigma, Mu Sigma Tau, Pilot's Club, Industrial Cooperative Program.

Leonard A. Mende, EE '55; Eta Kappa Nu, Engineering Council, Big Red Band, Dean's List.

William Mueller Robey, CE '54; Dean's List, Chi Epsilon Pyramid, honor committee School of Civil

Engineering, Phi Kappa Sigma.

John F. Schneider, ME '54; Pi Tau Sigma president, Beta Theta Pi, Kappa Tau Chi secretary, Freshman tennis numerals.

Norbert Schnog, EE '54; Eta Kappa Nu president.

Robert M. Shapiro, CE '54; Chi Epsilon, Big Red Band, Intends to stay at Cornell for master's degree in philosophy.

Ralph R. Stevens, Jr., EP '54.

S. Sherwood Strong, ME '55; Men's Glee Club, Campus Conference on Religion co-chairman, Pi Tau Sigma, Kappa Tau Chi secretary, Freshman Camp counselor, Phi Kappa Psi, Dean's List.

James M. Symons, CE '54; American Society of Civil Engineers vice-president, Chi Epsilon secretary-treasurer, Acacia treasurer, Dean's List.

Robert Alan Vanderhoek, ME '54; Pi Tau Sigma, Kappa Tau Chi, Acacia treasurer-steward, Dean's List.

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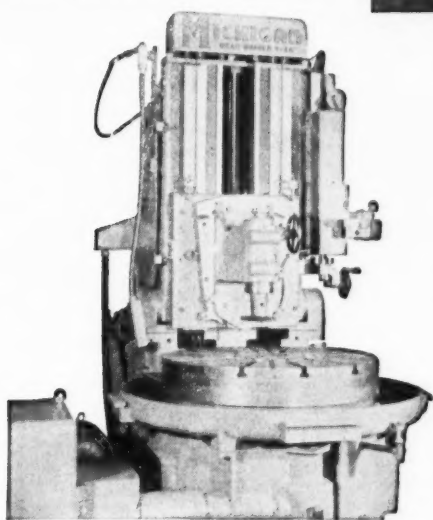
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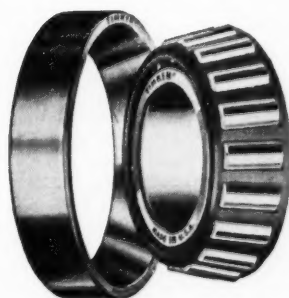
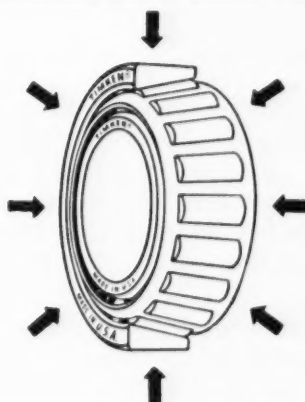


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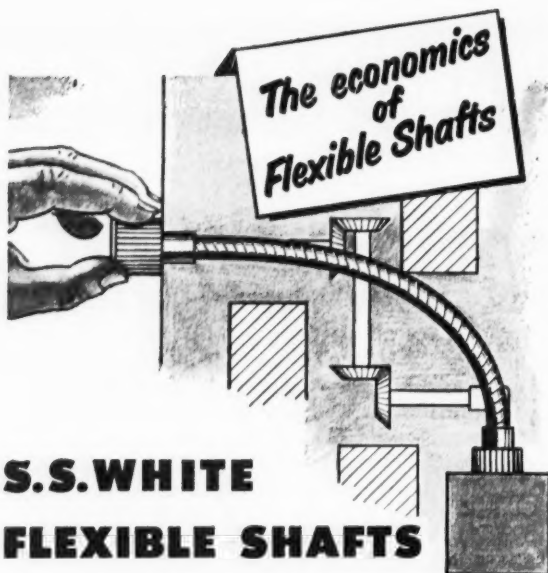
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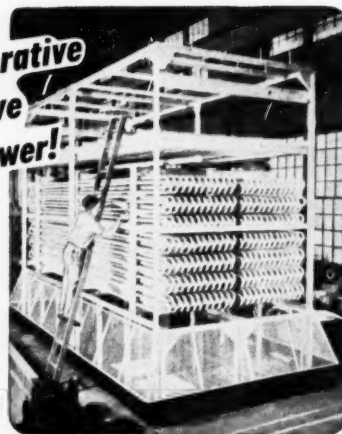


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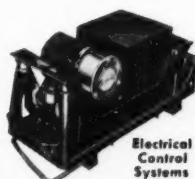
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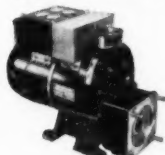
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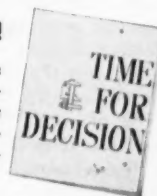
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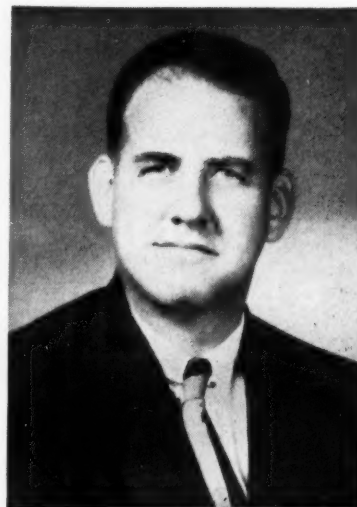
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W. R. Sears, Director of the Graduate School of Aeronautical Engineering
L. P. Smith, Director of the Department of Engineering Physics

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish closer relationship between the college and the alumni."



Thomas W. Hopper

Engineers have played a leading role in the great industrial expansion that has taken place in this country over the last fifty years. Today they are the leaders in practically every type of business of which one can think. Engineering as a profession is held in great esteem by the people and by government officials. The opinions and advice of engineers are sought on most of the problems that beset the affairs of men. They speak with authority on matters of public welfare and private enterprise alike.

Engineers should guard this high standing of their profession carefully and with zeal. They should try to give even greater service as the opportunities permit. They should adopt professional ideals and live by them to the best of their ability.

A professional engineer is one who embraces a philosophy of service—service to the community, service to his client or employer, and service to his fellow practitioners. He should make a sustained effort to improve his ability, to advance the technology of his field, and to strengthen the engineering profession.

Professional engineers are expected to be competent and careful in their work. They are expected to consider all factors pertaining to a project and to exercise judgment and integrity in formulating opinions affecting others. A young engineer may accept a position as technician, draftsman, or mechanic while in training, but he should keep in mind that a professional engineer will always be expected to consider and appraise the facts as well as to perform a skillful operation.

The difference between an engineer and a professional engineer is principally an attitude or way of looking at one's work. Both men can have equal education, training,

and ability, but the professional engineer adopts a code of ethics and a philosophy based on service to others.

Most states have registration laws which stipulate minimum qualifications of education and training or the passing of examinations before engineers can engage in private practice. For the large group of engineers in industry, however, there is no formal admittance to professional status as in the case of the medical and legal professions. The professional responsibilities of such engineers are no less real and can be as exacting.

It is important that engineers, especially young engineers entering the field, become familiar with the concepts of professionalism and set up standards for personal performance similar to the following recommendations:

1. That you adopt a professional attitude in which
 - a. You are always willing to do more than that for which you are paid.
 - b. You first ask yourself, "Is it good for those who will use it?"
 - c. "Is it for the best interest of your employer or client?"
2. That you continually try to improve your knowledge and ability.
3. That you take an interest in your profession by supporting your technical society.
4. That you become a registered professional engineer so that your employer and the public will know of your legal qualifications in this profession.
5. That you do everything in your power for the overall good of your profession and your country.

THOMAS W. HOPPER

THE CORNELL ENGINEER

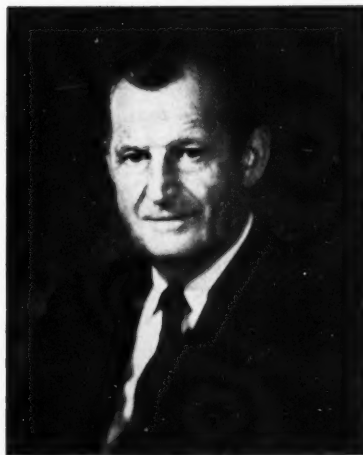
ALUMNI ENGINEERS

William W. Hoy, C.E. '95, is a civil engineer with offices at 524 Fifth Street, Santa Ana, Cal.

C. Gilbert Peterson, M.E. '06, Hillcrest Park, Stamford, Conn., has retired as chief engineer of Railway Express Agency. He joined Railway Express in 1934 after being with the airplane division of Ford Motor Co.

Herbert L. Trube, M.E. '08, is in the insurance and pension business with offices at 20 Pine Street, New York City 5. He now lives at Newtown Avenue, R.D. 1, Norwalk, Conn.

Adolph Stuber, M.E. '12, retired on January 1 as vice-president of sales and advertising for Eastman Kodak Co., Rochester; he will retire from active duty at the end of April. During his forty-one years with Kodak, he has participated in the development and production of new and improved photographic equipment and in the application



Adolph Stuber

of photography to business, industrial, and scientific needs. Stuber, who lives at 175 Ambassador Drive, Rochester, is also a director of Union Trust Co. of Rochester, the National Foreign Trade Council, and Brand Names Foundation.

Eric T. Huddleston, B.Arch. '10, received a fellowship in the American Institute of Architects last June, becoming the first architect

in northern New England to be so honored. Huddleston, for many years head of the department of architecture at the University of New Hampshire in Durham, has been with the architectural firm of I. W. Hersey Associates since 1935, and has built numerous schools and public buildings throughout the State. He is also author of the Huddleston Plan, which was designed to eliminate unfair bidding practices in building construction and which has become the basis for a State law in Massachusetts. Although he has retired from his administrative duties, he continues as a member of the teaching faculty and as university architect.

Donald C. Miller, M.E. '12, has retired after many years as sales engineer with Griswold Manufacturing Co. in Erie, Pa., where he lives at 1680 West Twelfth Street.

Charles E. Finney, Jr., M.E. '12, 625 Hurlingham Avenue, San Mateo, Cal., has retired from the Standard Oil Co. of California after being with them for nearly thirty-four years.

James R. Cook, C.E. '20, is at present manager of the Puerto Rico office of Buck, Seifert & Jost. A consulting sanitary engineer, he lives at 2013 Calle Violeta, San Turce, Puerto Rico.

William L. Lewis, M.E. '22, vice-president in charge of the Endicott plant of International Business Machines Corp., has been named vice-president in charge of the company's purchasing. His address is 35 Crestmont Road, Binghamton.

Henry G. Warnick, M.E. '24, is a supervising engineer for the Manhattan-Bronx-Westchester area of the New York Telephone Co. Warnick and his family, including three children, live at 52 Holls Terrace South, Yonkers 3.

George S. Bibbins, E.E. '24, is Program Transmission Engineer with the Long Lines Department of American Telephone & Telegraph Co. He has been with the company since he was graduated from Cor-

nell. His son Charles is now in his 4th year at Cornell and is majoring in Economics. He plans to get a Master's Degree in the Business Administration School in June, 1955. His daughter is a junior in high school and plans to attend Cornell. George lives at 32 Pine Terrace East, Short Hills, N.J.

Moorhead Wright, E.E. '27, 58 Turner Drive, Chappaqua, was appointed manager of the management development services depart-



Moorehead Wright

ment of General Electric Co., New York City. In his new post, Wright will head research in the company's management development program and assist operating managers.

Commander B. Otto Roessler, C.E. '31, was transferred from Guantanamo Bay, Cuba, to U.S. Naval Training Center, Bainbridge, Md., where he is public works resident officer in charge of construction. His address is Qtrs. "O," USNTC, Bainbridge, Md.

Don C. Hershey, B.Arch. '31, 5 Landing Road, South Rochester 10, was elected president of the Rochester Society of Architects for 1953-54.

Edmund C. Sulzman, M.E. '34, was recently made chairman of the Cleveland-Akron section of the Institute of the Aeronautical Sciences. He is vice-president of Jack & Heintz, Inc., Cleveland, Ohio, and is now residing at R. D. 4, Chagrin Falls, Ohio.

O. Allen Jillson, M.E. '36, was released from the Navy last summer after twenty-eight months of duty as a lieutenant commander. He

Alumni Engineers

(Continued from page 35)

is now assistant purchasing agent for Chemical Construction Corp., New York City. He and his wife and four children live at 222 Valley Court, Haworth, N. J.

Norman Dawson, Jr., B.M.E. '46, has been appointed superintendent of the Brass Bellows Division of Flexonics Corporation. He moves from Elgin, Illinois, where he has been quality control manager, to Memphis, Tenn., where the company has just completed a plant addition. Very active during his college career in student government work and in athletics, he has taken an active part in the supervision of football and baseball tournaments in Illinois. Dawson and his wife Marilyn have two children, Thomas, four years, and Dianne, one and a half.

George Sutton, B.M.E. '52, is a development engineer on rocket motors at Cal. Tech. jet propulsion laboratories. He received his Master's degree in engineering at Cal. Tech. last spring. George calls 1122 B North Stoneman Avenue, Alhambra, Calif., his home.

John F. Coffin III, C.E. '50, is teaching science and coaching the hockey team at Lawrenceville School, Lawrenceville, N.J. He is the son of Foster M. Coffin '12, Director of Willard Straight Hall.

Donn Innes, M.E. '51, son of Donald F. Innes '17 married Carolyn Heyl '52 in Delmar, October 17. Ushers were John W. MacDonald, Jr. '49, Latham Burns '51, and Murray R. Wigsten '52. The bridesmaids were Dolores MacDonald '52 and Nancy Taylor '52.

Robert M. Frank, B.M.E. '41, Ph.D. '51, has joined the staff of the Los Alamos Scientific Laboratory of the University of California. He and his wife (Evelyn Wahl '41) live with their two children at 4756 Trinity Drive, Los Alamos, Calif.

Bart E. Holm, C. E. '47, '48, Keystone Heights, Fla., is now with E. I. du Pont de Nemours & Co. at their Trail Ridge Plant for the mining of titanium ore.

Albert J. Monahan, Jr., E.E. '50, is doing field engineering work with Hughes Aircraft Co., Culver City, Calif. His home is at 23 Bonnie Brae, Utica.

Rocket Research

(Continued from page 22)

Such a rocket could be constructed to carry a passenger to an altitude of several thousand miles with known fuels and tolerable accelerations. A rocket of this type would be an invaluable research tool, probing the problems of the nature of the upper atmosphere, the complexity of rocket flight and stability, and the effect of space conditions upon the human body. Careful engineering would insure safety and success in a machine that has reasonable and attainable design requirements. To win public support, to stimulate necessary financial backing, to generate sincere enthusiasm among technical men, the protagonists of space flight must direct their efforts toward concrete achievements and actual flights rather than profusely illustrated dreams and generalizations. The challenge of space will be met only by hard work, steady progress, and logical addition to present knowledge. A transition manned research rocket provides the next step toward the realization of space travel.

It is true that the plans of Von Braun and of advocates of theories of electron-beam and light-ray power sources represent the thinking of experts in their fields. It is true that in long range perspective it cannot be denied that their ideas may become realities. Yet the significance of present accomplishments in the V-2, the Viking, Aerobee, and Wac-Corporal, and of research into the human reaction to high speed flight, must not be overlooked. Space will be conquered. Men will overcome the bounds of the earth and travel among the planets. But to do so, they will employ step-by-step advancements stemming from present rocket research. The true prophets of the coming era of space travel are the scientific workmen in the laboratory, at the drawing board, or on the proving ground, who are focusing their dreams into practical realities, and testing and retesting existing designs to learn the exact nature of rocket flight. The men and methods of contemporary rocket research are the true pioneers in man's slow but steady journey upward along the stairway to the stars.



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THE DU PONT DIGEST



Technical Sales

A major in glibness and a minor in solid information—those were the mythical requirements for a salesman in the old days. But they really never sufficed for a man selling the products of chemical technology.

Today, the diverse applications of Du Pont's 1200 products and product lines create a need for trained sales personnel representing many different technical backgrounds. These men must deal intelligently with problems in chemistry and engineering applied to such fields as plastics, ceramics, textiles, and many others.

Du Pont technical men are assigned to various types of technical sales activity. In some spots they are equipped to handle all phases of sell-

ing. In others they deal mainly with customer problems. Also, certain departments maintain sales development sections, where technical problems connected with the introduction of a new product, or a new application for an established product, are worked out.

For example, a technical man in one of Du Pont's sales groups was recently called upon to help a customer make a better and less expensive hose for car radiators. Involved were problems in compounding, such as choice and amount of neoprene, inert fillers, softeners, accelerators, and antioxidants. Correct processing methods also had to be worked out, including optimum time and temperature of milling and extruding. The successful completion of this

project naturally gave a good deal of satisfaction to the customer as well as Du Pont.

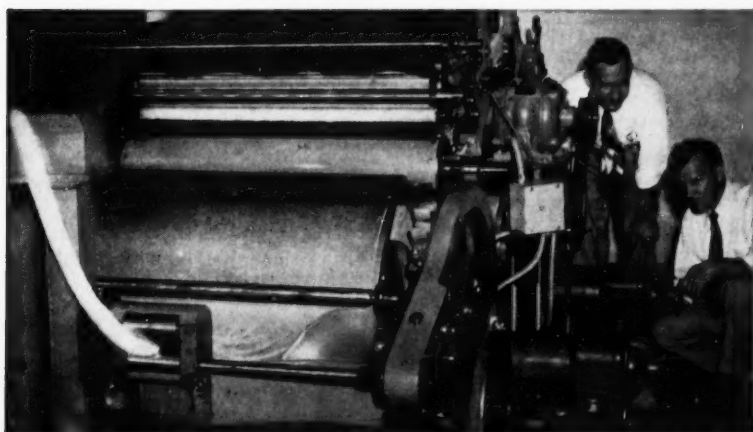
In another case a customer wanted to reduce carbon contamination of arc welding rod stock. A Du Pont technical service man suggested changes in cleaning procedures that lowered contamination by 90 per cent. The new process also reduced metal loss during heat treatment—a benefit that more than offset the cost of the additional cleaning operations.

Technical men interested in sales work usually start in a laboratory or manufacturing plant where they can acquire needed background. Depending on their interest and abilities, they may then move into technical sales service, sales development, or direct sales.

In any of these fields, the man with the right combination of sales aptitude and technical knowledge will find interesting work, and exceptional opportunities for growth in the Du Pont Company.



W. A. Hawkins (left), B.S.M.E., Carnegie Tech., demonstrates extrusion of "Teflon" tetrafluoroethylene resin for a customer.



James A. Newman, B.S. in Ch.E., North Carolina State (left), discusses study of optimum settings and conditions for carding nylon staple with Prof. J. F. Bogdan of North Carolina State's Research Division.

ASK FOR "Chemical Engineers at Du Pont." This new illustrated booklet describes initial assignments, training, and paths of promotion. Just send a post card to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington, Delaware. Also available: "Du Pont Company and the College Graduate" and "Mechanical Engineers at Du Pont."



BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

Watch "Cavalcade of America" on Television

TECHNIBRIEFS

Techniques for converting a continuous tone image into a line drawing by means of a new photographic technique have recently been developed by the Eastman Kodak Company.

The conversions—which result in an effect similar to that of a pen-and-ink drawing—may be produced from any sharply detailed good photographic film negative. No additional art work is necessary to fit most such pictures for reproduction, but in cases where important characteristics or details must be clearly reproduced, these may be enhanced or added by the artist to a tone-line print.

When used as a base for further art work, the process results in the production of pen-and-ink type pictures in much less time than is normally required to make such drawings. It also makes possible the photomechanical reproduction of illustrations for many general industrial and other purposes without the use of a half-tone screen.

In operation, this process combines a negative with a positive of nearly equal contrast, so that the positive in effect acts as a mask for the negative. The negative and the positive are then taped together in register and placed in contact with a sheet of Kodalith Film. The Kodalith Film is then exposed either by rapidly spinning the printing frame underneath a fixed light, or by rotating a movable light above a stationary frame. Either method allows some light to work its way around the edges of the mask and negative, and produce a line image on the film.

This method is quite distinct from solarization methods of producing outlines or from the pseudo-relief effect obtained by using a negative and a positive slightly out of register with each other.

Recording Gage For Low Temperature Liquid Study

A low-temperature instrument that measures, indicates, records, and controls the level of liquefied gases such as hydrogen or nitrogen

has recently been developed by W. E. Williams and E. Maxwell of the National Bureau of Standards with the cooperation of the Brown Instrument Division of Minneapolis-Honeywell Regulator Co. This electronic instrument operates on the capacitance principle and makes use of the difference in dielectric constants of the liquid and vapor states. The sensing element is a vertical cylindrical capacitor whose capacitance is a function of the height of the liquid refrigerant column. The NBS instrument is designed to be used interchangeably with hydrogen, nitrogen, oxygen, or helium merely by changing the sensitivity and range controls on the associated electronic circuitry. It also incorporates a control system that maintains the liquid level at a predetermined point.

X-Ray Camera For High Temperature Research

An X-ray camera capable of studying materials at temperatures up to 4,000 degrees Fahrenheit has been developed for ceramic research at Oak Ridge National Laboratory.

The camera, designed by Dr. J. R. Johnson, technical advisor on the Laboratory staff, has been used successfully to produce diffraction patterns in studies of hafnium oxide, as well as a number of other oxides and metals.

To photograph the diffraction pattern of the material under study, X-rays produced in a standard X-ray tube pass through a tube guide mounted on the film holder, then through a small disk of beryllium and a collimator. The X-rays strike a rotating sample and are diffracted through a beryllium "window" and the pattern image is registered on photographic film.

The camera consists of a base, top cover, and film holder, with all working parts and facilities except the top-cover water leads and the vacuum gauge mounted on the base. The camera is usually operated with a purified helium atmosphere.

When the camera is in operation, the specimen under study is heated by a pair of small tantalum-strip resistance heaters, surrounded by a radiation shield. Constant temperature, i.e., plus or minus 5 degrees Fahrenheit, is maintained by supplying a constant power to the heaters, which require 900 watts at the highest temperature.

It is possible to photograph the X-ray diffraction patterns through a periphery of nearly a half circle. Approximately 8 degrees of the periphery are cut out on either side of the entrance and emergence ports; there is a complete unobstructed picture from 8 degrees to 172 degrees. Another 20 degrees are lost in the shadows of the electric and water leads at the 270-degree position.

Tape-Recorded TV

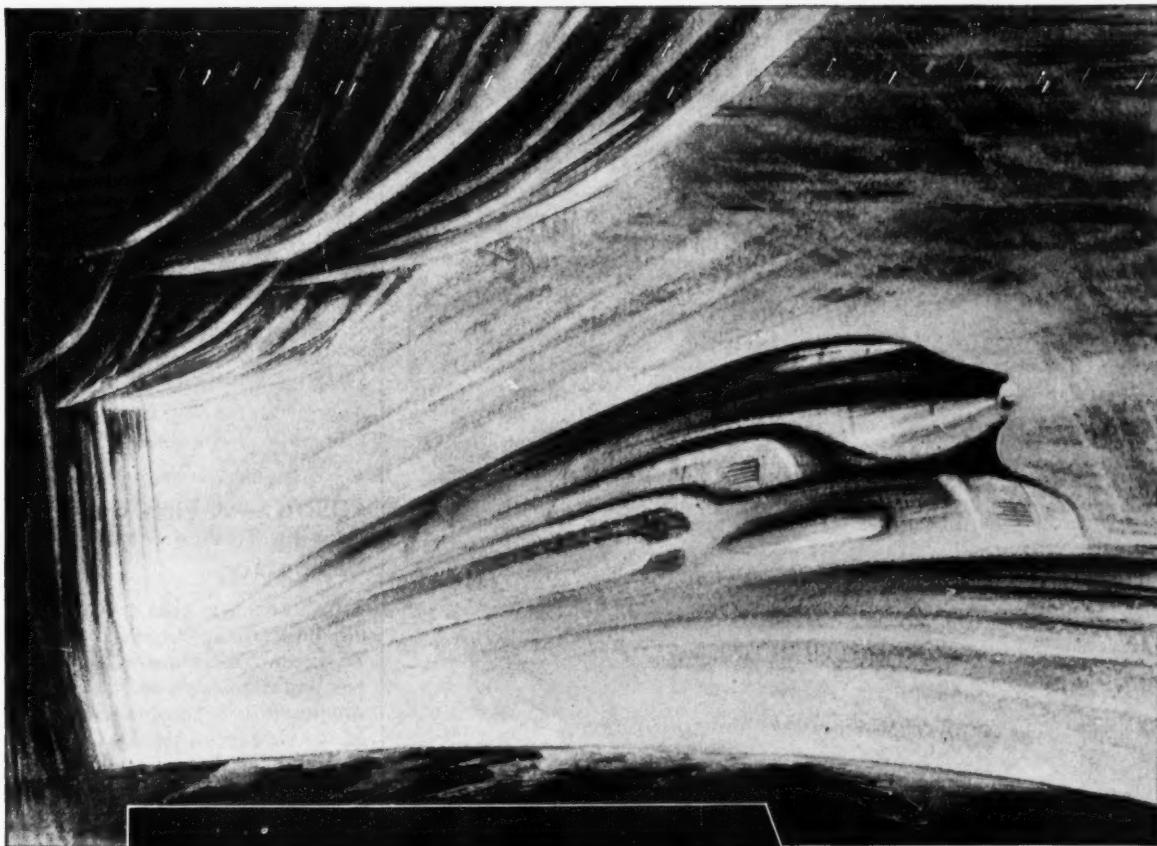
Recording of television pictures on magnetic tape in color and in black-and-white was publicly demonstrated in December for the first time by the Radio Corporation of America at its laboratories in Princeton, N.J. According to present estimates, the cost of recording color television on magnetic tape will be only five per cent of the recording cost for color film, since the tape can be reused.

RCA's method of video recording is similar, in basic respects, to the techniques used to record speech and music with present-day magnetic tape sound equipment. Electrical signals are impressed through a recording head—a small horseshoe electromagnet—onto the magnetically treated surface of a plastic tape. As the tape is drawn across the recording head, the head continuously changes the magnetic polarity of the magnetic oxide particles on the tape so that they become a compact code of the original signal.

For playback, the tape is drawn across the same, or a similar head. The magnetic "shorthand" on the tape causes an alternating current to flow in the windings around the reproducing head. The reproduced current closely duplicates the original signal.

Although the principles are similar, the engineering problems are

(Continued on page 40)



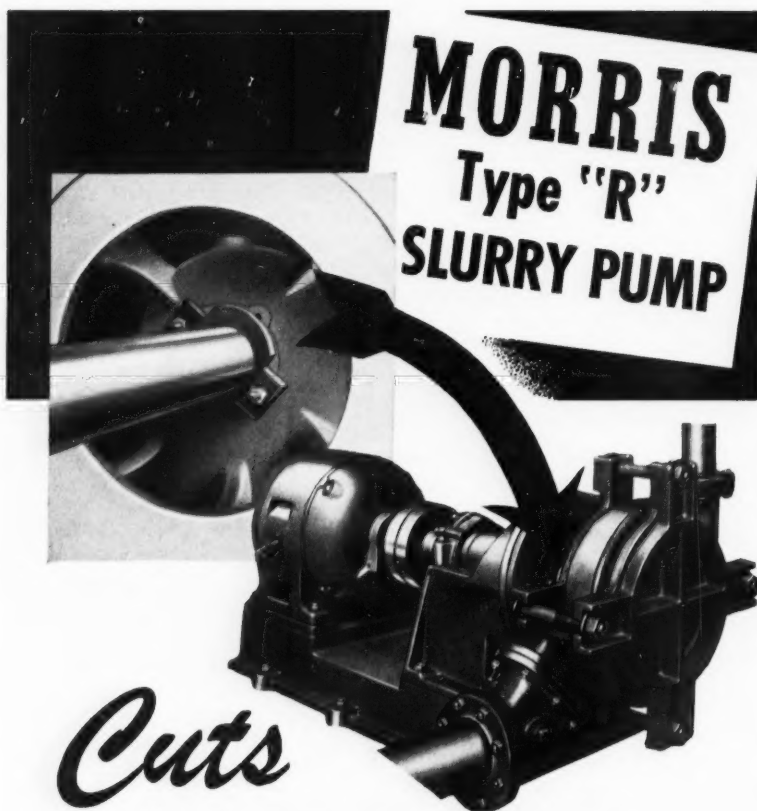
BEYOND THE HORIZON....

Designers are seeking new alloys from the metallurgist in order to develop higher speed transportation.

Higher speed calls for materials having greater strength in lighter sections, often with little or no sacrifice in toughness. Molybdenum contributes vital properties to better alloys which will certainly be developed for the future.

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Fluctuating Sealing Water Pressure is No Problem when you install a Morris Type R Slurry Pump. Even when peak demand on the plant supply line lowers the pressure, this pump operates with minimum stuffing box wear. Only 10% normal sealing water pressure is actually required... because Morris Type R stuffing box is subject to *suction pressures only*. Low line pressure is therefore sufficient to shut out grit effectively... and still protect the slurry from objectionable dilution.

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Technibriefs

(Continued from page 38)

not; audio recording is today an easy task compared with video recording. The reason is that audio signals are in the range of 20 to 20,000 cycles per second, while video signals range up to 4,000,000 cycles per second. And color television signals, as now formulated, must carry at least twice as much pictorial information as black-and-white. In addition, video tape must carry the associated sound signals.

FOSDIC—A Film Optical Sensing Device for Input to Computers

An instrument that provides rapid, automatic processing of information into a form suitable for direct input to large-scale electronic computers has been developed by M. L. Greenough, H. D. Cook, M. Martens and associates of the National Bureau of Standards at the request of the Bureau of the Census. Named FOSDIC (Film Optical Sensing Device for Input Computers), the machine reads marks on microfilmed copies of documents that have been marked with an ordinary pencil or pen, and then processes the information into electrical pulses which are recorded on magnetic tape for direct input to an electronic computer such as the Census Univac. FOSDIC is designed to reduce the work that is now involved in converting written records into a medium acceptable as input by data-processing machines. This is particularly true since FOSDIC allows considerable freedom in design of the documents and does not require the use of any special writing instrument.

It is anticipated that ultimately the use of this machine will reduce appreciably the massive amount of paper-work entailed in summarizing Census information on the entire population. Although designed for census operations, FOSDIC may be generally applied to the processing of other types of information that must be handled in large quantities.

(Continued on page 42)

Navy's new radio "Voice" dedicated to America's security

WORLD'S MOST POWERFUL MILITARY RADIO TRANSMITTER A 6-YEAR NAVY-RCA PROJECT

On Jim Creek, in the State of Washington, stands the world's most powerful military radio transmitter—its giant antenna stretches from mountain peak to mountain peak.

A 6-year project of the Navy and RCA, "Big Jim" was built and installed to provide the Navy, for the first time, with instant communications with naval units everywhere, on the seas and under the seas, on land and in the air.

Speaking at the dedication ceremonies, Brig. Gen. David Sarnoff, Chairman of the Board of RCA, said: *"May I express the wish, which I know all in our Armed Services share, that this powerful instrument for transmitting intelligence may add to our national security and to the peace of the world."*

The first message flashed by the "Big Jim" transmitter was from Admiral Robert B. Carney, Chief of Naval Operations, to U. S. Navy personnel around the world. He said:

"With this message we forge another link between you and your homeland. With it, we build a new security channel from America to the naval units which form its outer ramparts of defense."

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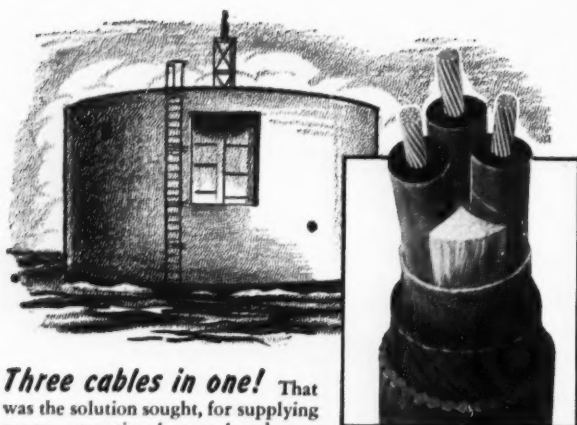
AT DEDICATION CEREMONIES—Gen. Sarnoff operates key to transmit first radio message, dictated by Admiral Carney, to American fleet units around the world.



RADIO CORPORATION OF AMERICA

World leader in radio—first in television

FEBRUARY, 1954



Three cables in one! That was the solution sought, for supplying power, operational control and communication to a pumping house $4\frac{1}{2}$ miles off shore in Lake Okechobee, Florida.

As usual, Okonite engineers were consulted on the problem. Their studies showed that it was possible to combine a three-fold function in one cable. This was accomplished by the use of Okolite high-voltage insulation whose electrical characteristics permitted carrier current to be superimposed on the power conductors.

The result was a single Okonite-insulated cable—steel-armored for the $4\frac{1}{2}$ underwater miles, with a non-metallic sheath for an additional $2\frac{1}{2}$ miles underground—which supplies not only power and operation control, but a communication circuit as well.

Tough jobs are the true test of electrical cable . . . and installations on such jobs usually turn out to be Okonite.



insulated wires and cables

8787

(Continued from page 40)

Reports from NBS:

Radio disturbance forecasting, sorting machines, and high voltage

Since January 5, 1954, the National Bureau of Standards has broadcast short-term radio propagation forecasts for the North Pacific area from its standard frequency broadcasting station WWVH, the Hawaiian counterpart of the Bureau's Washington station, WWV. The disturbance notices tell users of radio transmission paths over the North Pacific the condition of the ionosphere at the time of the announcement and how good or bad communication conditions are expected to be for the next 12 hours. Forecasts are prepared three times daily by the Bureau's North Pacific Radio Warning Service at Anchorage, Alaska. Currently, only those forecasts issued at 8 A.M. and 4 P.M. (Alaska and Hawaiian time) are to be relayed to WWVH, Territory of Hawaii.

The North Pacific forecasts issued by NBS apply only to short wave radio transmissions over paths that are near the auroral zone

for a considerable part of their length. In this zone the ionospheric layers are very likely to be disturbed, and because short-wave, long-range radio transmissions are dependent on the condition of the ionosphere, communications may be disrupted. Often the ionospheric disturbance accompanies intense magnetic field variations and a brilliant aurora. The resulting propagation effects range from severe fading to a complete break in the communication link. The NBS forecasts of propagation conditions for the next few hours supplement the more general forecasts made several days in advance and permit a more efficient utilization of the short-wave radio spectrum for communications.

An improved machine for sorting physical objects into a large number of categories has recently been developed by the National Bureau of Standards. Designed by J. Rabinow of the NBS electromechanical ordnance laboratory at the request of the Bureau of Census, the device was built to sort punched cards at the rate of 420 cards per minute.

CORNELL LEADS AGAIN!

On the morning of January 4th the campus community had their first glimpse of the most modern college store in the country. The Cornell Campus Store has escaped from the dark basement and has set up a campus shopping center of which all Cornellians can be proud.

The job is not finished—we are still correcting mistakes and re-arranging our stock. But we are getting nearer our goal every day and all departments are open for business.

The new Cornell Campus Store has a single purpose—to offer better service to all members of the campus community. We hope that you like the new store and we welcome your suggestions and criticisms.

THE CORNELL CAMPUS STORE

OLD ARMORY

The principle, however, is applicable to sorting such other objects as mail, electrical and mechanical components, and even farm produce as well as checks, invoices, and other papers. Any items that can be separated into a number of subdivisions can be handled by an electromechanical system similar to the NBS sorter.

A miniature electrostatic source of high voltage for use with radiation survey instruments has been developed by S. R. Gilford, S. Saito, and J. L. Herson of the National Bureau of Standards. The device is an adaptation of the work of Holtz and Wommelsdorf on influence-type generators of conventional size, but it uses modern printed circuit and miniaturization techniques. Operation of this type of generator depends on the ability of one charged body to induce a charge on another body close by. The device is one result of a program sponsored by the Navy Bureau of Ships for the investigation and application of techniques adaptable to low-cost mass production of radiation survey instruments.



put yourself in his place . . .

A year ago he was knee-deep in textbooks, plugging for his B.S. Tonight he's on his way to Vancouver, or Miami, or Portland, Maine. Tomorrow he'll help an Alcoa customer make a faster ship, a stronger shovel, a lighter highway trailer.

In Alcoa laboratories, plants and sales offices from coast-to-coast, ambitious young Sales Development Engineers are helping to make aluminum more useful, in more ways, to more people. We need more men just like them to help us meet ever-growing demands for Alcoa Aluminum . . . Alcoa "know-how".

Maybe you are already thinking about trading your textbooks for a position in production supervision, industrial research or sales engineering. Tell us about it, give us an idea of your background in Chemical, Electrical, Mechanical, Metallurgical or Industrial Engineering.

Good men go places fast with Alcoa, in their daily associations with leaders in the aluminum industry. Right now it may be quicker than you think from a seat in the classroom to your career with Alcoa. Why not find out?

Your Placement Director will be glad to make an appointment for you with our Personnel Representative. Or just send us an application, yourself.

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ALCOA ON TV brings the world to your armchair with "SEE IT NOW" featuring Edward R. Murrow. Tuesday evenings on most CBS-TV stations.



To many people, Grinnell is known best as a producer of high quality malleable and cast iron pipe fittings or perhaps as



the manufacturer of Grinnell Automatic Sprinkler Systems. But there are other reasons behind Grinnell's leadership in the piping field. For example . . .



Grinnell makes **PIPE HANGERS** and **SUPPORTS** of all types . . . from the simplest hanger for domestic service to engineered hangers which provide flexible but constant support for piping at such temperatures as 1000°F.

Grinnell manufactures special **VALVES**, including **DIAPHRAGM VALVES** . . . designed to handle corrosive fluids, gases, beverages, foods, compressed air, suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

Grinnell **WELDING FITTINGS** and **FLANGES** are available in many different metals.

Grinnell, in short, offers industry a *full line* of piping supplies — including pipe, valves, fittings, hangers and other piping products. **GRINNELL** is an experienced well-rounded team of piping specialists, backed by highest quality products.



GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell runs a six-months training course at Providence, R. I. to acquaint engineering college graduates with modern piping engineering practice and products and with Grinnell Company operations. If you are a graduating or a graduate engineer, the Grinnell training course offers

you an exceptional opportunity for a sound education in piping engineering and sales and good chances for advancement. For further information, write directly to:—
H. B. Cross, Executive Secretary, Grinnell Company, Inc., Providence, Rhode Island.



There's plenty of "head room" for you at Boeing

If you are a senior in any field of engineering, it would be advisable to consider the advantages of a career at Boeing after you graduate.

Boeing, for instance, makes a policy of "promoting from within." Regular merit reviews give you steady opportunity and recognition. And in a company with a growth record like Boeing's, there's always plenty of "head room" to move into.

Another advantage at Boeing is career stability. Boeing has grown practically continuously during its 37 years of operation. Today Boeing actually employs more engineers than even at the peak of World War II.

Still another Boeing advantage is the variety of experience and contacts available to you here. Boeing is constantly alert to new materials and techniques, and approaches them without limitations. Extensive subcontracting and major procurement programs—all directed by engineers—give you contacts with a cross section of American industry. Aviation, in fact, is unique in its variety and breadth of application—from applied research to production design, all going on at once.

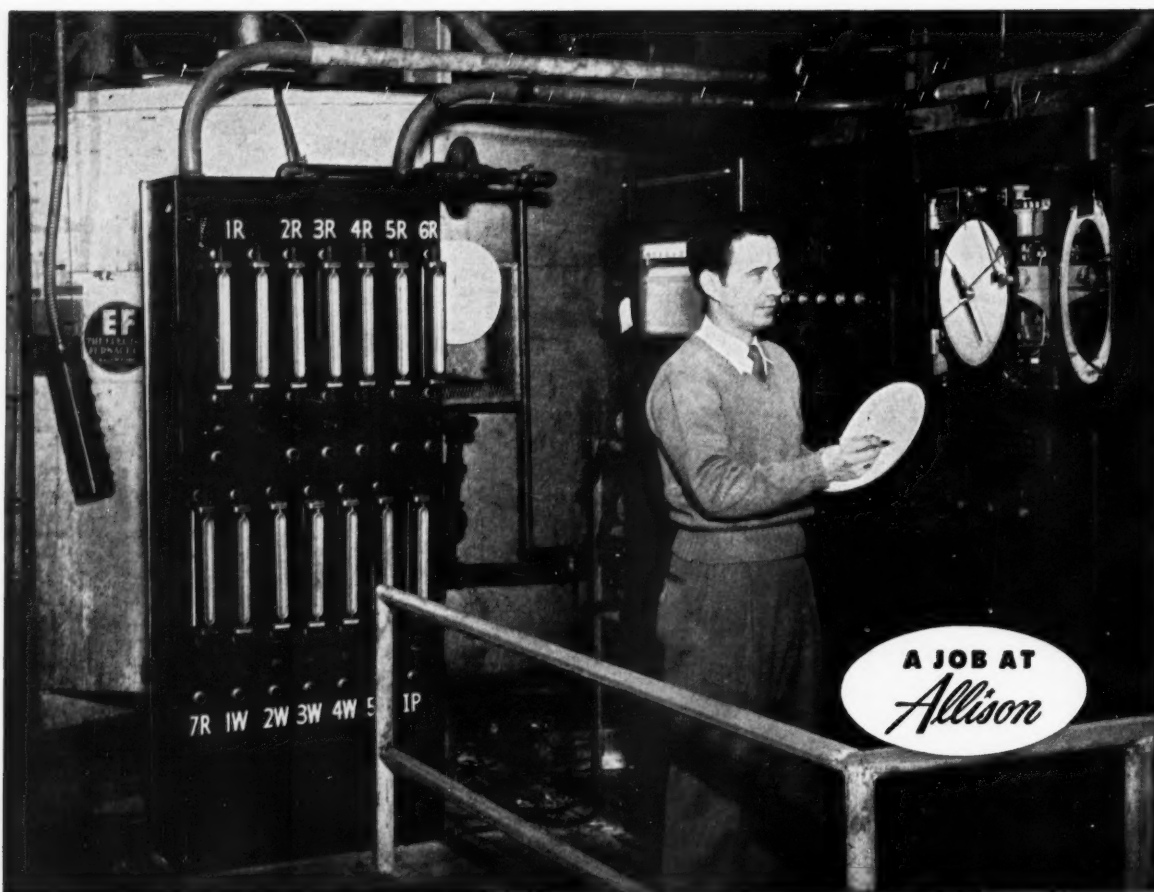
At Boeing you'd work in Seattle, Washington, or Wichita, Kansas—two fresh, modern cities with a wide variety of recreational facilities, fine shopping and residential districts, and universities

which provide excellent graduate study courses. The company will arrange a reduced work week to permit time for this study and will reimburse tuition upon successful completion of each quarter's work.

There are openings in all branches of engineering (mechanical, civil, electrical, aeronautical, and related fields) for DESIGN, PRODUCTION AND RESEARCH. Also for servo-mechanism and electronics designers and analysts, and physicists and mathematicians with advanced degrees.

For further information, consult your PLACEMENT OFFICE, or write
JOHN C. SANDERS, Staff Engineer—Personnel
 Boeing Airplane Company, Seattle 14, Wash.

BOEING



● Even before he was graduated from the U. of Kentucky, Sam Griffin, Jr. was "sold" on a job at Allison. His brother-in-law, who is in Allison aircraft engine test section, had told him about the many advantages and opportunities offered the young engineer with academic training like his.

So, when Sam left school in 1951 with his B.S. in Metallurgical Engineering, he came right to Allison where he is now Experimental Metallurgist in Transmissions Operations.

Allison, along with its aircraft engine activity and production of bearings and Diesel locomotive parts, is the world's largest manufacturer of Torqmatic Drives for heavy duty Ordnance and commercial vehicles

and equipment. In all parts of the world, Torqmatic Drives are in use today in big trucks . . . tractors . . . cranes . . . shovels . . . tanks . . . drilling rigs . . . and scrapers.

After Engineering designs a part, such as—let's say—a spur gear, knowing what it must do, and the hardness required to do its specific job, it's up to the metallurgists to select a steel and heat treatment to meet the specifications. That's an important responsibility in the Allison Transmissions operations where as many as 700 different parts go through heat treat. Proper control here means less rework, and when the perfect surface is produced, the part is "ready to go," without grinding.

Sam has been doing pioneering work in heat treatment control with newly-installed equipment at Allison. He is shown above, as final tests are being made, at the panel of the Dew Point Recorder which checks the amount of moisture in heat treat furnaces. Twenty-four big furnaces are controlled by these two- six-station machines. It was his responsibility to see that the equipment was installed properly, and he also trains personnel in the proper use of the equipment.

The long range program at Allison offers unlimited opportunities to competent graduate engineers in various fields. Why not plan *early* for your engineering career at Allison.

Allison DIVISION, GENERAL MOTORS CORPORATION • Indianapolis, Ind.

Design, development and production—high power TURBINE ENGINES for modern aircraft . . . heavy duty TRANSMISSIONS for Ordnance and Commercial vehicles . . . DIESEL LOCOMOTIVE PARTS . . . PRECISION BEARINGS for aircraft, Diesel locomotives and special application.

STRESS and STRAIN...

*I never kiss, I never neck.
I never say hell, I never say heck;
I'm always good, I'm always nice.
I play no poker, I roll no dice.
I never drink, I never flirt,
I never gossip or spread the dirt;
I have no lines or funny tricks,
But what the hell,
I'm only six.*

ME: "How did you puncture that tire?"

EE: "Ran over a milk bottle."

ME: "Didn't you see it?"

EE: "Naw, the kid had it under his coat."

The dime isn't entirely worthless—it makes a fairly good screw-driver.

In the days of Queen Elizabeth 'tis said, some of the ladies of the court liked to curl up with a good book, while others preferred individual pages.

1st co-ed: "Joe proposed to me last night and I'm sore at him."

2nd co-ed: "What made you so mad?"

1st co-ed: "You should have heard what he proposed."

"So you're a painter?"
"Yep."
"Paint houses, I presume?"
"Nope. Paint men and women."
"Oh—I see, an artist."
"Nope. Just paint 'Men' over one door and 'Women' over the other door."

A sorority girl wrote home: "... and I am gaining weight on this awful food that they serve, too. I weigh 120 stripped, but I don't know whether the scale in front of the drug store is right."

She: What would you say to a girl that went around kissing all the men she meets?

He: Pleased to meet you.

A young woman motorist was spending her first night in Texas in a trailer camp. The next morning one of the neighbors came over and mentioned that the site was right next to the largest helium plant in the world. "How wonderful!" she replied. "Is it in bloom now?"

The M.E. student walked into the psychiatrist's office, tore open a cigarette, and stuffed the tobacco up his nose.

"I see," said the doctor, "that you need my help."

"Yes," said the M.E. "Do you have a match?"

A Cornell student arrived at the pearly gates, where St. Peter asked him who he was. When told he was a science student, St. Peter said, "Go to the Devil." Some time later an ag student arrived, and upon being asked who he was, replied that he was an ag student; he was told to go to Hell. The third Cornell man arrived at the pearly gates with his slide rule. When asked who he was, he replied, "I'm an engineer." Whereupon St. Peter said, "Come in, son. You've been through Hell already."

Wife: "The new maid has just burned the bacon and eggs, darling. Wouldn't you be satisfied with a couple of kisses for breakfast?"

M.E. husband: "Sure, bring her in."

"Did you get home from the party all right last night?"

"Fine, thanks, except that as I was turning into my driveway some idiot stepped on my fingers."

Three men were sitting on a park bench. The man in the middle was sitting quietly as though asleep. But the two men on either side were going through the motions of fishing. With deadly seriousness they would cast, jerk their lines gently, then swiftly wind their imaginary reels. This had gone on for some time when a policeman sauntered over, shook the man in the middle and demanded, "Are these two nuts friends of yours?"

"Yes, officer," replied the man. "Well, get them out of here then."

"Right away, officer," said the man as he began to row vigorously.

Co-ed: Do you believe in free love?
E.E.: Have I ever sent you a bill?

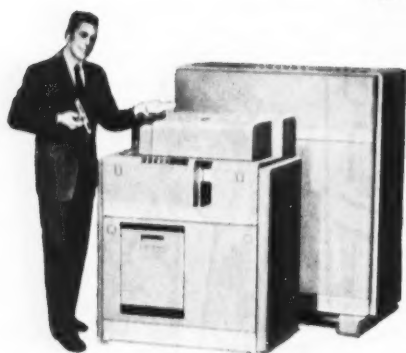




*Leonardo da Vinci's
Flying Machine*

In the time of Leonardo da Vinci, men had to take great risks to further the progress of science. The attempt at flight pictured here was made in 1505—with near-fatal results.

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Type 604 Electronic Calculator

The risks and costs of exploring industrial, business and scientific facts and theories are being cut to the minimum by the use of IBM Electronic Computers and Business Machines.

IBM Machines help tell aeronautical experts the flight characteristics of an unbuilt plane; geologists where to drill for oil; business men where to look for sales and profits . . . and IBM engineers how to design better IBM Machines.

Helping mankind to pierce the unknown makes a fascinating career.



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then each month photography records the total,
precisely right, ready for correct billing.**

TWENTY-FOUR hours a day, hundreds of thousands of dial phones click their demands in many central exchanges of the New York Telephone Company.

Little meters keep careful tally of the calls. Then the night before each bill is dated, photography reads the up-to-the-minute totals in a fraction of the time it could be done in any other way. Here is an idea that offers businesses everywhere simplification in copying readings on meters, dials or other recording instrumentation.

Photography fits this task especially well for two reasons. It is lightning fast. It can't make a mistake.

This is another example of the ways photography saves time, cuts costs, reduces error, improves output. In large businesses—small businesses—photography can do big jobs. In fact, today so many new applications of photography exist that graduates in the physical sciences and in engineering find them valuable tools in their new occupations. Other graduates—together with returning servicemen—have been led to find positions with the Eastman Kodak Company.

If you are interested, write to Business and Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.

Eastman Kodak Company
Rochester 4, N. Y.



At New York Telephone Company exchanges a unique camera records the dial message register readings—up to 25 at a clip—saving countless man-hours of labor, assuring utmost accuracy and at the same time providing a permanent record.

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RESEARCH—World famous for its achievements in both pure and applied science, G-E research is led by scientists whose names are known everywhere. The many Company laboratories cover a wide range of scientific investigations. Research activities include physics, chemistry, metallurgy, mechanical and electrical problems, ceramics, and many other fields.

ENGINEERS

IS YOUR CAREER HERE?

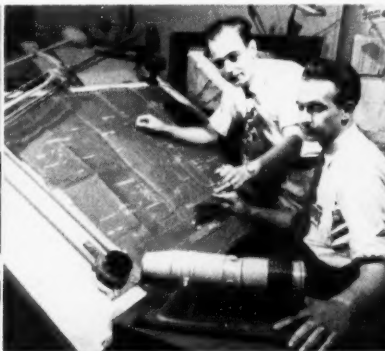
Sound engineering is one of the foundation stones of General Electric's leadership in the electrical industry. The importance of the role of the engineer has been recognized from the very beginning of the Company. Since 1892, G.E.'s Engineering Program—the oldest on-the-job training program in industry—has been affording young engineers widespread opportunities for professional development.

Besides the engineering fields briefly described here, career opportunities with a bright future are waiting for engineers in other important fields at General Electric . . . in manufacturing engineering . . . sales engineering . . . installation and service engineering . . . advertising . . . administration . . . other specialties in engineering.

If you are an engineer interested in building a career with an expanding and ever-growing Company see your college placement director for the next visit of the G-E representative on your campus. Meanwhile, for further information on opportunities with G.E., write to College Editor, Dept. 2-123, General Electric Co., Schenectady 5, N. Y.



DEVELOPMENT ENGINEERING—Development engineers are continually obtaining and assessing new basic engineering and scientific knowledge to make possible new developments. They serve as consultants to help in the solutions of engineering problems, which often require research, experimentation, and the development of a new product or component.



DESIGN ENGINEERING—To maintain leadership in the electrical field, design engineers are constantly striving to develop new and better products. Their skill is largely responsible for the steam and gas turbines, motors, heat pump, control equipment, and many other products. In electronics, they design equipment for television broadcasting and reception, radar, and other electronic equipment.



APPLICATION ENGINEERING—Since much equipment today is designed for a specific use, the application engineer must have a broad knowledge of the industry for which a particular product is being designed. Because G-E products are widely used throughout industry, imagination, determination, and a sound knowledge of engineering are important assets in this ever-growing field.

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